YUKON TRANSPORTATION STUDY

Summary Report

Prepared for
Government of Canada
Department of Indian Affairs
And Northern Development

By

Travacon Research Limited
Calgary Alberta

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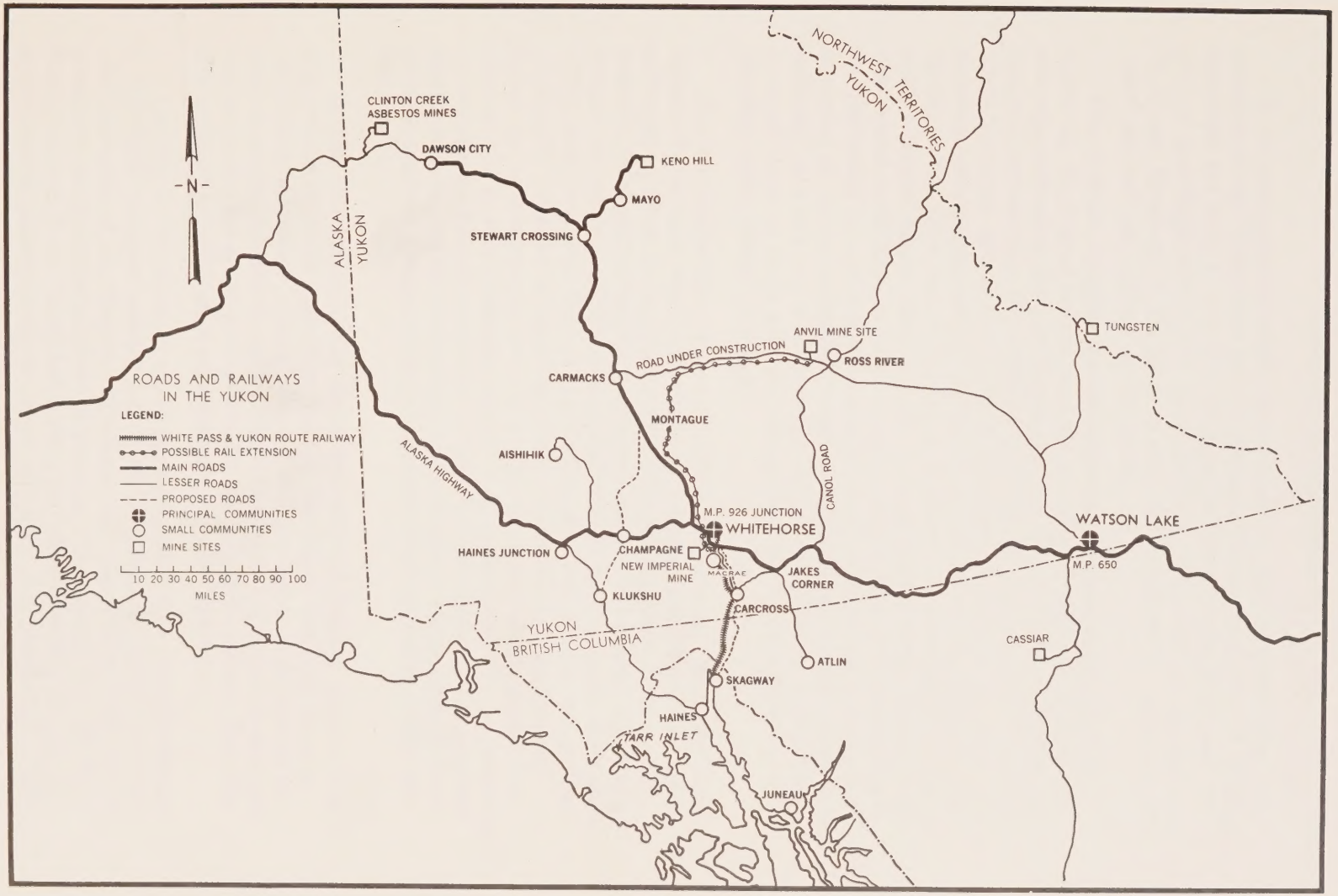
ROADS AND RAILWAYS
IN THE YUKON
LEGEND:
WHITE PASS & YUKON ROUTE RAILWAY
POSSIBLE RAIL EXTENSION
MAIN ROADS
LESSER ROADS
PROPOSED ROADS
PRINCIPAL COMMUNITIES
SMALL COMMUNITIES
MINE SITES
10 20 30 40 50 60 70 80 90 100
MILES
-N-
NORTHWEST TERRITORIES
YUKON
ALASKA
YUKON
CLINTON CREEK
ASBESTOS MINES
DAWSON CITY
KENO HILL
MAYO
STEWART CROSSING
ANVIL MINE SITE
TUNGSTEN
ROAD UNDER CONSTRUCTION
ROSS RIVER
CARMACKS
MONTAGUE
AISHIHIK
ALASKA HIGHWAY
CANOL ROAD
M.P. 926 JUNCTION
WHITEHORSE
WATSON LAKE
HAINES JUNCTION
CHAMPAGNE
NEW IMPERIAL
MINE
MACRAE
JAKES
CORNER
M.P. 650
KLUKSHU
CARCROSS
YUKON
BRITISH COLUMBIA
CASSIAR
ATLIN
SKAGWAY
HAINES
TARR INLET
JUNEAU

SUMMARY OF FINDINGS

In the course of this study, many important questions affecting transportation in the Yukon have been examined. The analysis of each of these questions has been as complete as possible but no doubt some gaps to present knowledge will remain and continue to raise controversy well into the future. However, on the basis of such knowledge as the study has provided, several conclusions can be drawn.

One of these concerns the development of egress routes from the Yukon via the Port of Haines, and the use of such routes as a means of resource outhaul in place of Skagway routes. The analysis of Haines and Skagway harbours has demonstrated that there is little to choose between the two in terms of port development. However, analysis of the costs of overland outhaul quite clearly indicates the inferiority of a Haines route insofar as the major part of the Yukon Territory is concerned. Development of Haines routes other than the existing Haines Road – Alaska Highway system could have an effect in preventing strains from developing in the Territorial transportation system if future traffic volumes were greatly in excess of currently forecast volumes, but this possible advantage is not sufficient to offset cost disadvantages for expected traffic. A building of cut-off roads to tie in with the Haines Road would not appear to be justified under present conditions.

Another conclusion concerns the Skagway-Carcross Road. The development of this route would offer some advantages, but these would not be sufficient to offset its high costs. The Skagway-Carcross Road would probably be of greater benefit to Skagway than to Whitehorse, which may account for the very active interest residents of the Panhandle have shown in the route. It is true that the route would give rise to some strong "psychological" benefits in providing another outlet for the "landlocked" Yukon, but to comment on these is beyond the scope of this study. The concern here is with economic benefits and, as nearly as can be ascertained, the proposed route would provide few of these. Moreover the proposed route would do nothing to alleviate traffic problems which could in future occur on territorial roads owing to a mixture of heavy mining traffic and local traffic.

A third conclusion is that the present rail and highway system, with some relatively minor upgrading, is fully capable of handling resource traffic as now forecast. Considering all relevant costs, it is cheaper to move resources at present and forecast volumes to tidewater via the present road and rail system than to develop any alternative route. How long this is likely to hold true is an important question however.

Looking to the future, it would appear that the best overall solution to the Yukon transport problem lies in rail development based on a northward extension of the Skagway-Whitehorse rail line. In this study such an extension was examined in terms of transport of resources from the Ross River area and it was found that while a rail extension does not appear economical at present, volumes would only have to approximately double

over those presently forecast to make a railroad extension economically feasible. This suggests that trends indicative of possible future mining output in the Yukon will have to be watched closely, so that appropriate planning for rail development can be undertaken at the right time in view of the long lead time such planning requires.

Present trends appear to indicate that in a relatively few years, a major capital investment may be required in a Yukon development railroad. If such a railroad were to be constructed, one major effect would be to weaken the case for the construction of some of the roads examined in this report. Care should be taken that scarce capital resources should not be wasted on an unnecessary and costly duplication of transport capacity.

INTRODUCTION

This publication is intended to give the interested public the main findings of the Yukon Transportation Study undertaken for the Government of Canada (Department of Indian Affairs and Northern Development) by Travacon Research Limited. The study was started in January 1967 and submitted to the Minister of Northern Development eight months later, in September.

The study was undertaken for two principal reasons. First, the Yukon economy is now changing rapidly. Some of the older mines on which the Territory has traditionally relied have already gone out of production or are being phased out. New projects are getting under way, and the stir of excitement about mining prospects knows no precedent except perhaps the Gold Rush. The rapidly expanding economy of Japan appears to be in a growing position to absorb large mineral outputs from the Canadian West, including the Yukon, and there is increasing interest in the adequacy of routes to tidewater for large scale mineral outhauls. If the Yukon Territory is to participate fully in the growth of mineral production which the far western parts of Canada should experience, its transportation links must be adequate to the task.

The study was also undertaken to shed light on some important transportation issues which are of great concern both to the residents of the Yukon and the Government of Canada. Perhaps, foremost among these is the question of the Skagway-Carcross Road. The Minister of Indian Affairs and Northern Development directed that a cost benefit study of this road should be undertaken. Following this directive, the Department of Public Works undertook a study of engineering costs and route location in the summer of 1966. On the basis of the Department of Works cost data, adjusted where necessary, Travacon have estimated the net gains or losses which would accrue to the Yukon economy if this road were built.

Other issues of interest are the future of the Haines Road in Yukon transportation, the questions of Tarr Inlet and a possible road to Juneau, the comparative suitability of developing Haines and Skagway into large volume ports, and finally, the question of possible rail development into the Yukon interior based either on the present railroad between Skagway and Whitehorse, or the new route from Haines.

Summarizing, the study examined the following possible transportation changes to the present system:

1. New highway from Skagway to Carcross and upgrading the highway from Macrae to Carcross.
2. New highway from Skagway to Carcross, upgrading the highway from Macrae to Carcross, and upgrading the Tagish Road from Jakes Corner to Carcross.
3. New highway from Montague to Klukshu.
4. New highway from Champagne to Klukshu.
5. New highway from Montague to Champagne.

6. New highway from Haines Road to Tarr Inlet (with possible new highway from Montague to Klukshu).
7. New highway from Atlin to Juneau, upgrading the Atlin Road and new highway to replace the Canol Road from Ross River to Johnsons Crossing.
8. Upgrading program for the White Pass and Yukon Railway.
9. Railway extension from Macrae to the Ross River area.
10. Development of high volume port facilities at either Skagway or Haines.

In addition to these changes in the fixed parts of the transportation network, alternative assumptions were made concerning the routing of traffic from the potential and existing mines in the Yukon.

The Travacon report, as submitted to the Minister of Indian Affairs and Northern Development could not be published in its original form because it contains extensive confidential information on the present operations and forward planning of specific companies engaged in business in the Yukon. All companies approached were most co-operative in providing information, but supplied it on the understanding that it would not be made public in a form that would reveal its source and identity. In view of the wide public interest in the Travacon study, the only apparent alternative was to publish this summary which includes its main findings, but does not violate the confidentiality of contributions made by specific companies to the data with which the Travacon Research team worked. The summary has been prepared by Travacon Research Limited and is representative of the views and conclusions submitted to the Minister of Northern Development in the original Travacon Report.

Part I THE YUKON TRANSPORTATION NETWORK AND ITS CHANGING REQUIREMENTS

1.1 Tidewater Links at Present

The study focuses on traffic flows between the Yukon and Tidewater ports in Alaska. It is not concerned with flows entering the Yukon by means of the Alaska Highway except insofar as these have a direct bearing on tidewater traffic flows.

Present traffic between the Yukon and tidewater is carried almost entirely by the White Pass & Yukon Corporation through its Highway Division, Rail Division, and Pipeline Division. Southbound commodity traffic consists very largely of mineral resources from the Yukon and northern British Columbia which move to world markets via the Alaskan port of Skagway. In addition to minerals, a very small quantity of general freight moves to tidewater. Southbound tonnages on the White Pass route in 1966 consist of 80,000 tons of asbestos fibre from Cassiar, British Columbia, destined to Vancouver; 24,000 tons of lead, zinc and silver concentrates from United Keno Hill Mines near Mayo also moving to Vancouver; and 1,200 tons of miscellaneous commodities consigned to Vancouver and beyond.

Northbound freight traffic on the White Pass system moves by two methods. Non-volatile petroleum products are transported in a four-inch pipeline operated by the Company, and non-liquid commodities and gasoline move on the White Pass narrow gauge, 110-mile railway. It is estimated that a total of approximately 120,000 tons of freight moved northbound in 1966, and that half of this was transported by rail and half by pipeline. Approximately two-thirds of this total consisted of petroleum products. Of the northbound tonnage, approximately 50 percent is consigned to Whitehorse and the remainder goes forward by highway to points on the Alaska Highway and to the Northern Yukon.

The White Pass system is one means whereby goods and people can be moved between the Yukon and tidewater. The Haines road represents another such means. However, although this route is important in Yukon tourist traffic, it has not been significant for the movement of goods.

1.2 Yukon Internal Transport System – at Present

Whitehorse is the hub of the Yukon transportation system. At Whitehorse outgoing goods are collected via the territorial road system for trans-shipment to tidewater on the White Pass railroad, and inbound rail shipments are broken up for distribution to various Yukon locations. During recent years volumes which have moved southbound through Whitehorse have come very largely from two mines, the Cassiar asbestos mine in north-central British Columbia and the United Keno Hill Mine in north-central Yukon. The Cassiar

traffic moves via the Stewart-Cassiar road to the Alaska Highway near Watson Lake, thence via the Alaska Highway to Whitehorse, while the movement from the United Keno Hill Mines is by the Territorial Road System via Mayo, Stewart Crossing and Carmacks to Whitehorse.

Current resource and general commodity movements to and from Whitehorse are small, and the road system adequately handles the limited frequencies at which trucks now move. The White Pass rail link to tidewater is also quite capable of moving all present volumes. However, new mines which will soon be in production will alter this situation and may provide traffic volumes which could strain existing facilities and create undesirable mixtures of passenger automobiles and heavy truck traffic.

1.3 Future Commodity Traffic

As the following forecast shows, a large growth of southbound tonnage is expected during the next few years:

1966 (actual)	105,200 tons
1968	181,200 "
1970	561,200 "
1972	611,200 "

The increases in volumes over the 1966 level will come from two mines, and primarily the Anvil Mine, which is to begin production in the vicinity of Ross River in the fall of 1969. The other source of increased traffic is a new asbestos mine placed in production by the Cassiar Company at Clinton Creek near Dawson in October 1967. The forecast in the Table allows for the continued movement of resources from existing producers, Cassiar Asbestos at Cassiar, New Imperial Mines near Whitehorse, and United Keno Hill Mines. It was assumed, however, that the United Keno Hill Mines will have been phased out of production by 1970.[1]

The forecast volume to 1972 must be viewed as conservative estimates of resources movements. It is based on current information from production plans of major mines. Based on experience in other new mining areas, such as Pine Point, there is at least a possibility that volumes by 1972 may be considerably higher than the forecast suggests.[2]

Northbound volumes moving through Whitehorse will also rise, although increases will be of a much lower magnitude than in the case of southbound volumes. It is estimated that by 1972, northbound volumes moving between Skagway and Whitehorse will be 166,900 tons, an increase of 48,300 tons over the 1966 level of 118,600 tons.

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[1] This assumption may no longer be valid, but the tonnages originating at United Keno Hill Mines are likely to be a minor proportion of gross southbound freight by 1970.

[2] In making this point, it is not being implied that there is any expectation that the Snake River iron deposits may be in production by 1972.

1.4 Present and Future Tourist Traffic

In view of the possible changes in tourism which might occur in the Yukon as a result of the proposed changes in the Yukon transportation system, estimates were prepared of the major tourist movements through the Territory. While all routings of tourists are not shown on the charts which appear on the next page, they are estimated to represent the principal flows. The charts have been compiled on the basis of the following information.

(a) Ninety percent of Yukon tourists visit mainland Alaska.

(b) Out of a total of 13,900 tourists who enter the Yukon on the Haines road, 12,500 proceed to mainland Alaska and 1,400 visit only the Yukon.

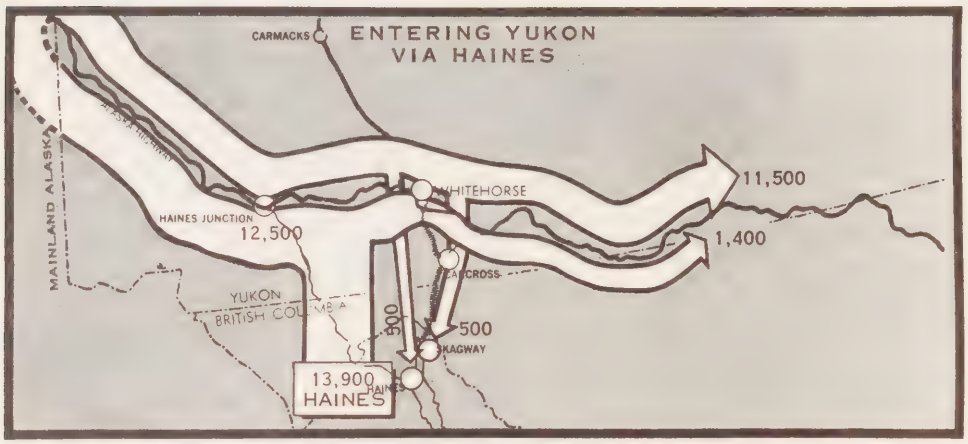
(c) Out of a total of 14,200 tourists who enter the Yukon via the the White Pass & Yukon Corporation Railway, 4,400 continue to mainland Alaska, 1,200 visit Whitehorse and return to Skagway, 500 visit only the Yukon and return via the Alaska Highway, and 8,100 are cruise ship passengers who visit Carcross and return the same day. (Some 6,100 cruise ship passengers visit Bennett, B.C., and return the same day.)

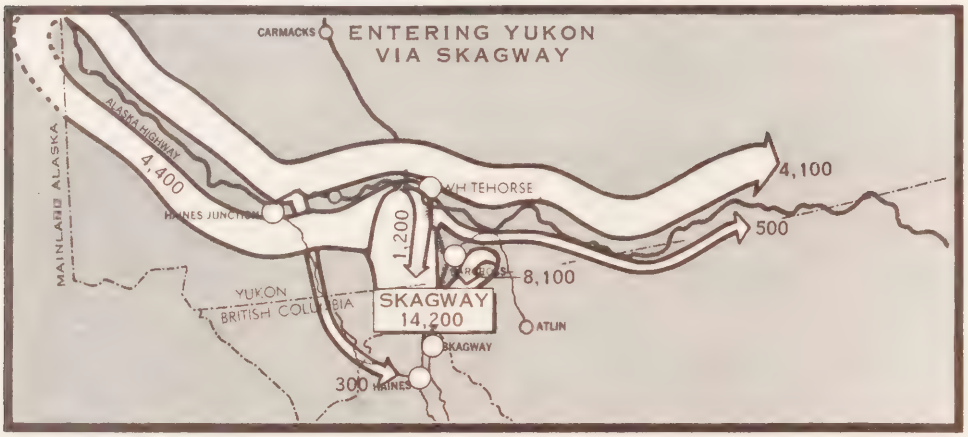
(d) Out of an estimated total of 35,100 tourists who enter the Yukon along the Alaska Highway from British Columbia, 31,600 proceed to mainland Alaska while 3,500 only visit the Yukon before returning. Most of the latter persons visit Whitehorse.

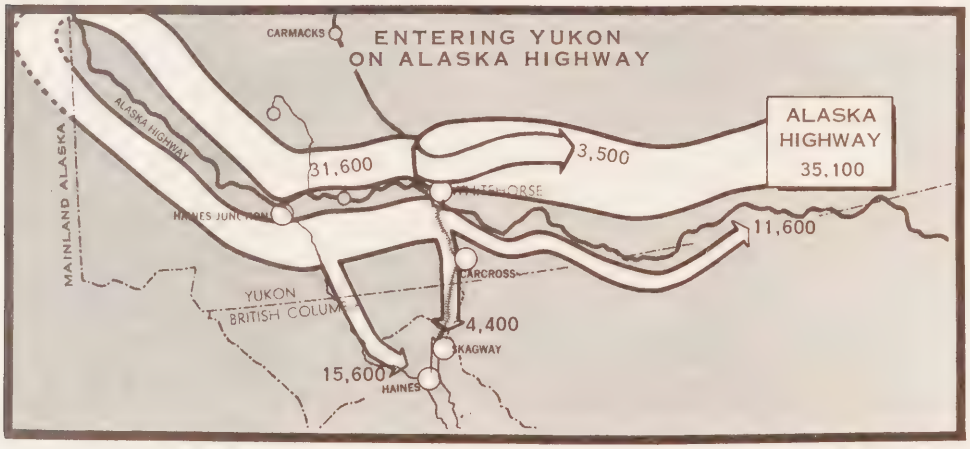
(e) Because the majority of tourist parties prefer not to travel across the same route twice, certain conclusions can be derived concerning their most probable routings. Most tourists who enter the Yukon on the Haines road will return south along the Alaska Highway. This applies also to those who enter via Skagway. However, tourists who enter via British Columbia along the Alaska Highway are faced with the limited Alaska Ferry capacity on their return routes. Although these parties form the majority of tourists leaving on the ferries, over 40% of them will return by the same route on which they came.

(f) Note that tourist traffic over the Carmacks road to Dawson City, an increasingly important tourist attraction, is included in the flow diagram with Alaska Highway traffic between Whitehorse and Mainland Alaska.

ESTIMATED NUMBER OF YUKON TOURISTS TRAVELLING IN AUTOS, BUSES OR PASSENGERS ON WHITE PASS RAILWAY IN 1966







Tourism to the Yukon has been increasing at a rate of some 12% per year in the past five years, and some 10% per year over the past decade. There appears every reason to believe that such rates of growth will continue provided that the lack of accommodation in peak months can be overcome and the capacity of the Alaska ferry system, another restraining factor on growth, is increased as planned.

On balance, it seems reasonable to forecast tourist growth rates of some 10% per year over the next decade. In accordance with the charts on the previous page some 63,200 tourists visited the Yukon in 1966. Therefore the estimated visitor count for 1975 will be in the range of 150,000, which indicates a substantial increase in passenger vehicles on the Yukon road system.

1.5 Adequacy of the Present Yukon-Tidewater Transport System

The Yukon-Tidewater transport system, meaning the White Pass railroad and the highway routes funneling into it, is currently operating with extensive excess capacity. It can accommodate much more traffic than it is presently required to handle. The important question becomes one of how much additional traffic it can be expected to handle before problems are encountered.

As shown by the traffic forecast, commodity volumes moving out of the Yukon are expected to undergo at least a fourfold increase by 1970. Trucks from the Anvil Mines alone will be required to move about 400,000 tons of concentrates per year at a frequency of some 40 trips per day. This means that during a 24 hour period, 40 trucks will move past a given point on the Mayo road in one direction, and an equal number will move in the opposite direction. Add to these trucks moving to and from Cassiar Mine at Clinton Creek, United Keno Hill traffic and general freight trucks – some further 50 truck movements daily, and the conflict with local passenger and tourist traffic will undoubtedly be serious.

Nevertheless, the present road and rail system, with some modifications, can handle the forecast traffic adequately. The road network would require only minor upgrading, and only small increases in highway maintenance. The White Pass and Yukon Railroad, however, would require additional motive power, rolling stock and other equipment, as well as upgrading of track and sidings.

The railway has been in operation for 67 years and although the plant is adequately maintained for present volumes of traffic it would have to be upgraded for carrying volumes approaching 600,000 tons per year. An upgrading program costing some $2.7 million would be required. This program would consist of the construction of a railyard at Macrae for the make-up and despatch of concentrate trains, re-ballasting the entire roadbed, the improvement of drainage through an extensive ditching program, a bank widening program, replacement of certain segments of track with

heavier rail, installation of tie plates on all sections, installation of new rail anchors, a selective tie replacement program, replacement of some rail on sidings, and the purchase of mechanized track machines to maintain the upgraded railroad.

It has been estimated that the upgraded railroad, with further plant improvements, would be capable of handling southbound volumes up to 2,000,000 tons annually.

In addition to the roadbed reconstruction, annual volumes of 600,000 tons would require expenditures of approximately $1.8 million for motive power and rolling stock.

With such an investment in the railway portion of the system, and with an investment of some $4,000,000 in port facilities at Skagway, the present Yukon-tidewater transportation network should be capable of efficiently carrying the volumes which are currently predicted.

As mentioned, movement of mineral concentrates from the Ross River region will require some 40 one-way truck movements per day. A doubling of the Ross River areas forecast mining output, would require twice as many one-way heavy truck movements, or 80 loaded trucks moving to Whitehorse (Macrae) and 80 moving in the opposite direction for a total of 160 movements per day. When mixed with traffic from other mines such as Clinton Creek, and allowing for some growth in normal traffic and the increase in tourist traffic, the situation could become most uncomfortable to the public travelling the gravel-surfaced roads. Planning is therefore necessary now to ensure a smooth flow of resource volumes to tidewater, and to provide for the normal transportation requirements of the Yukon Territory in future years.

Part II PORT FACILITY REQUIREMENTS

2.1 Port Facilities

Before discussing the alternative land transportation changes which have been examined it is appropriate to consider the possible port facilities to serve the Yukon.

An important part of the Yukon Transportation Study has been the evaluation of possible ports to serve the Yukon Territory for the movement of large quantities of bulk materials. It is well-known that a considerable amount of controversy has been expressed over the merits of the two principal port site possibilities for large shipments. In the past engineers have suggested that Dyea, near Skagway, would be the most suitable port site. Suggestions have been made that Skagway was too windy for a large port and that the Taiya Inlet acted as a wind tunnel. Difficulties have also been cited with land fill problems at Skagway. Other consultants have suggested that a port site near Haines would be the most suitable for a port, while yet others have recommended that Skagway was the best location.

Bearing in mind these alternative notions about suitability of port sites for handling future large scale Yukon resource out-movements, a port study was undertaken by professional engineers to objectively assess the merits of each site. For practical purposes the contending port sites are Skagway and Haines, or some site near either one of them. Accordingly it was decided to examine four sites in some detail, two at Skagway and two at Haines. The port study examined Skagway Harbour, Dyea, Haines (Lutak Inlet), and Haines (Letnikof Cove). Each of these sites was examined for topographic and geologic conditions, climate, hydrographic conditions, and other factors. The terms of reference were to assess the practical feasibility of each port site and to compare estimated capital and operating costs, in the context of the port shipping some 400,000 tons per year as a first phase and some five million tons per year as a second phase.

The engineers' complete report is contained in this volume as Appendix B.

In summary the study concluded that a site at Skagway would be entirely suitable for a port of the required scope, as would the two sites near Haines. While the estimated capital cost for constructing a port at Lutak Inlet, near Haines, was slightly lower than at Skagway, the estimated port operating costs were slightly lower at Skagway. The conclusion indicated that the choice of port sites should be made on the basis of the economics of overland transportation to each site.

The estimated capital costs and operating costs for the two most promising sites, at Skagway and at Lutak Inlet, are as follows:

Facility Capacity	Estimated Capital and Operating Costs of a Port Facility at Skagway and at Lutak Inlet*		
	At 400,000 T.P.Y.	Increase to 5 million T.P.Y.	Total @ 5 million T.P.Y.
Skagway			
Capital Cost	$4,046,000	$7,765,000	$11,811,000
Approx. Operating Cost	$0.85/L.T.	$0.75/L.T.	$0.75/L.T.
Lutak Inlet (Haines)			
Capital Cost	$3,688,000	$6,980,000	$10,668,000
Approx. Operating Cost	$0.90/L.T.	$0.80/L.T.	$0.80/L.T.

*Costs expressed in U.S. dollars.

Part III PROPOSED TRANSPORTATION ALTERNATIVES

3.1 Transportation Alternatives

If freight volumes were to rise significantly above the levels currently forecast, the present Yukon-tidewater transportation system might not only be overstrained in the sense of not being able to handle traffic flows smoothly and efficiently, it might also become a higher cost system than an alternative system.[1] The consequence might be a chronically undesirable mixture of traffic, increasing trip times, higher accident rates due to dust and other road conditions, and higher road maintenance costs. All of these are factors raising transportation costs, whether or not these can be stated in quantitative terms.

The important question, therefore, is what alternatives are available for the purposes of advance planning which could prevent undesirable conditions from developing. This question is a complicated one. First it must be determined whether the Yukon-tidewater transport system should be based on the port of Skagway or on some other port. The harbour terminals of Haines, Juneau, and Tarr Inlet would perhaps appear to be in the realm of possibility as alternatives, but Juneau and Tarr Inlet do not appear to offer any advantages.

Tarr Inlet has aroused the interest of Canadians because it would provide an all-Canadian route to tidewater, and would not require movement of Canadian goods through the Alaska Panhandle. However, owing to the presence of an unstable glacier (see map), the construction of a townsite and appropriate port would be most difficult, if indeed possible. Tarr Inlet is apparently extremely deep and would provide little suitable anchorage for ships. There is some record of icebergs in the channel (Glacier Bay) approaching the Inlet, and this would add to shipping hazards. A road to Tarr Inlet from the Haines Road would be some 90 miles long. Construction would be through territory which appears far too difficult for consideration at this time. Miles of tunnelling could be required as well as shelving along steep cliffs in order to circumvent the several major glaciers which flow to the sea along the route. Moreover, considering the distance that Tarr Inlet would lie by road from the interior parts of the Yukon, the economics of using it as a port would be most unfavourable in comparison with other routes.

The alternative of using Juneau as a tidewater port has two major disadvantages, the principal one being that it would require an excessive amount of new highway construction. Via the Mayo road the port would lie some 500 miles from the Ross River area, and more than 200 miles of new road construction or reconstruction would be required. The port could perhaps be reached more easily

[1] By "alternative system" is meant a modification of the present system which would significantly alter traffic flow patterns.

via the Canol Road but this routing would require an even more excessive amount of new road construction or reconstruction – some 240 miles. Developing Juneau as a port for Canadian resources would benefit the Atlin area of British Columbia and the Juneau area of Alaska, but it is difficult to envisage such a road as a direct catalyst to the development of the Northwestern part of the Yukon. Juneau cannot therefore, be considered as a practical alternative to Skagway as a port on which to base the Yukon-tidewater system.

Haines would appear to be the only practical alternative to Skagway. As shown in the previous part of this Summary the findings of the harbour engineering consultants were that adequate harbour sites could be developed at both Skagway and Haines, and that the question of which harbour is developed must depend largely on the economics of overland transport.

A variety of overland transport alternatives to the present system emerge as worthy of detailed analysis and these will be discussed in detail in subsequent sections. Briefly they may be classified into two groups:

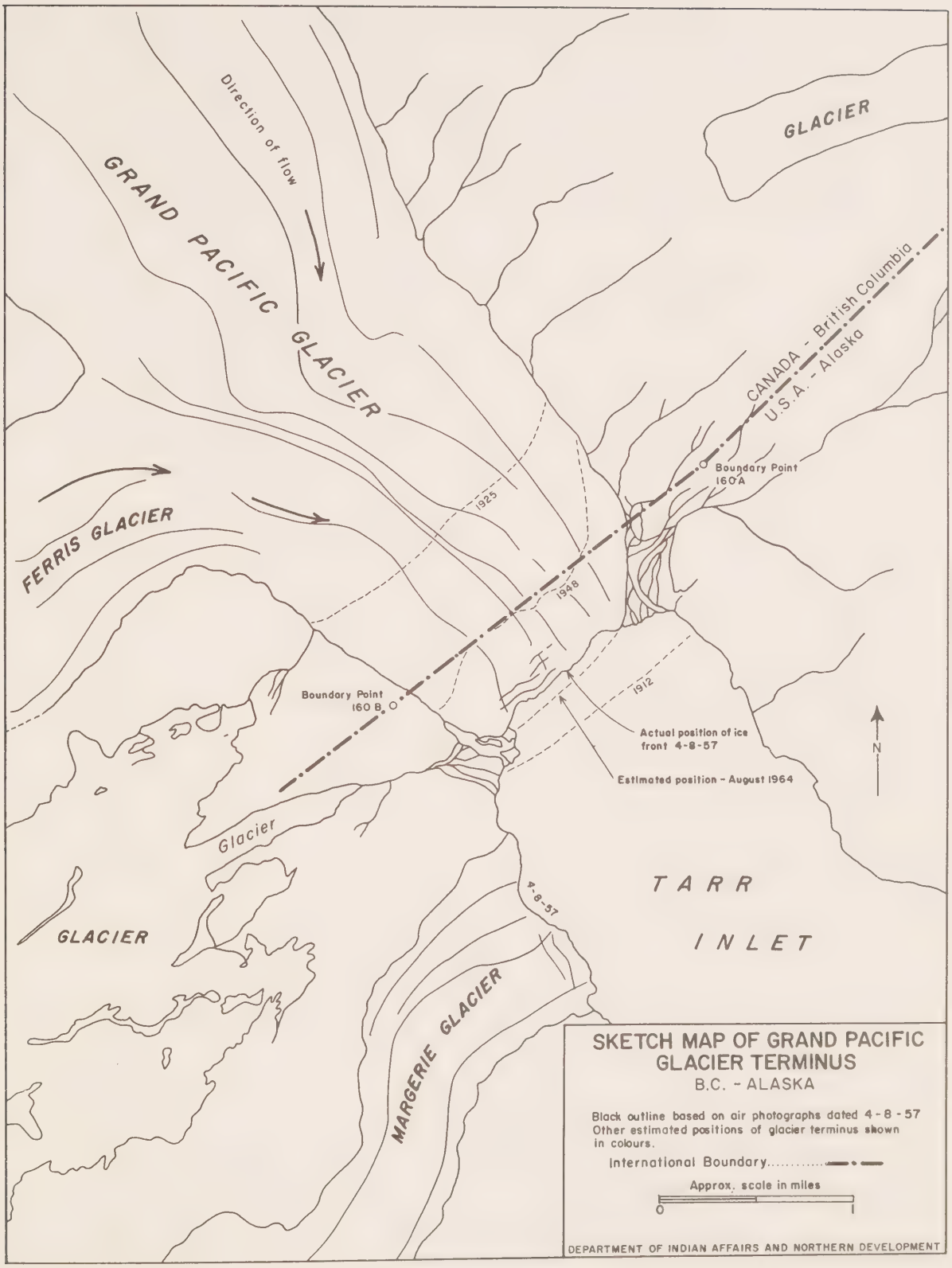
(a) Based on Skagway:

(i) Skagway-Carcross Road, and related road improvements.
(ii) Railroad into the Yukon interior.

(b) Based on Haines:

(i) Road improvements and new roads based on the Haines Road.
(ii) Railroad into the Yukon interior.

The main criteria under which these alternatives have been examined is their ability to provide a transportation system capable of handling present and foreseeable resource volumes, and sizeable increases beyond such volumes, at an economical cost. However, they were also examined in terms of their impact on industries such as tourism, on the cost of moving consumer goods into the Yukon, and in terms of their impact on the broader Yukon economy.


GLACIER
Direction of flow
GRAND PACIFIC GLACIER
CANADA - British Columbia
U.S.A. - Alaska
Boundary Point
160 A
1925
1948
FERRIS GLACIER
Boundary Point
160 B
1912
Actual position of ice
front 4-8-57
Estimated position - August 1964
N
Glacier
TARR
INLET
4-8-57
GLACIER
MARGERIE GLACIER
SKETCH MAP OF GRAND PACIFIC
GLACIER TERMINUS
B.C. - ALASKA
Black outline based on air photographs dated 4-8-57
Other estimated positions of glacier terminus shown
in colours.
International Boundary
Approx. scale in miles
0
1
DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT

Part IV IMPLICATIONS OF ALTERNATIVES

4.1 Construction of Skagway-Carcross Road

1. Route Location and Costs

A road which would link the Yukon road system more directly with a tidewater port than the Haines Road has been of interest to Yukon residents for some time. Accordingly, major attention has been given in this study to the feasibility and economics of a road to Skagway.

The Department of Public Works examined possible routes and costs during the summer of 1966. The routes investigated start at the Alaska Highway and cross over the Yukon Plateau to Carcross, proceed through the transitional zone between the Yukon Plateau and the Coast Mountains, and then cross the summit of the Boundary Range of the Coast Mountains before continuing down the valley of the Skagway River to the Pacific Coast.[1]

The Public Works study concludes that, there appear to be only two feasible alternative routes to link Skagway with Whitehorse –

(a) from the Alaska Highway via Carcross, by Tagish and Tutshi Lakes, through Warm Pass to Skagway, or

(b) an alternative beginning at Mile 68 of the Warm Pass route and following the Tutshi Valley to rejoin the original route at Mile 102 in the Skagway Valley. The latter route through the Tutshi Valley is favoured for the following reasons:

(i) The overall length of the Tutshi Valley route from the Alaska Highway to Skagway is 96 miles, of which 84 miles are in Canada, whereas the Warm Pass route from the Alaska Highway to Skagway is 109 miles, with 95 miles in Canada.

(ii) The estimated cost of the Tutshi Valley route for the portion in Canada is some $4.5 million less than the Warm Pass route.

(iii) The top of the pass in the Tutshi Valley is approximately 700 feet lower than the summit on the Warm Pass route.

(iv) There would seem to be much less danger from rock and snow slides on the Tutshi Valley route. Maintenance costs should also be lower on this route.

Furthermore, while it would be feasible but costly for the United States to build a road from Skagway to connect with either route, the Tutshi Valley route would have definite advantages. However, the costs of building any route to connect with a Canadian road

[1] The full report of the Department of Public Works is attached as Appendix C.

would be very high. A few miles of rough road have already been built toward the Canadian border from Skagway, but very difficult construction conditions have been encountered.

On the basis of lower costs and location advantages, the Tutshi Valley route for the proposed Skagway-Carcross road would appear to warrant primary consideration of the construction if the road proved justified. The estimated cost of constructing a gravel surfaced road over this route is $16,184,000 for the Canadian portion and $2,970,000 for the United States portion.

In addition to considering the construction of this road and consequent traffic movements, the possibility of upgrading the Tagish road in conjunction with building the Carcross-Skagway road was evaluated. This alternative, however, appears less economically attractive than considering the Carcross-Skagway road alone and need not be discussed in further detail.

2. Commodity Traffic Routing

This alternative was evaluated on the assumption that principal resource outbound traffic would move as follows when the road was opened.

By Truck:

Anvil to Skagway
Clinton Creek to Whitehorse
United Keno Hill to Whitehorse
New Imperial Mines to Skagway
Cassiar to Whitehorse

By Train:

Clinton Creek, United Keno Hill, and Cassiar from Whitehorse to Skagway

Inbound traffic to the Yukon mines would move as backhaul along the same routing as the outbound movement.

3. Passenger Traffic Routing

This alternative, including the construction of the Skagway-Carcross road, is the only one which could materially change the flows of passenger traffic in and around the Yukon.

(a) Tourist Traffic

First, tourist traffic was analysed, and two possible effects can be considered.

The first possible effect is a change in the number of tourists visiting the area. Growth in tourism is expected to continue at some 10 per cent per year, but there appears to

be no reason to suggest that the proposed Skagway to Carcross road would have the effect of attracting additional tourists to the area.

The second possible effect is a change in the pattern of tourist flows. Although it seems unlikely that the proposed road could attract completely new tourists to the area, there remains the question of whether it might not cause a diversion of traffic away from the Port of Haines.

For the purposes of examining the scope and effect of a possible diversion, assume that a complete diversion from Haines were to take place. In 1966 an estimated 13,900 tourists entered the Yukon via the Haines road while some 16,400 left the Yukon on this route. Therefore, an estimated 30,000 tourists used the Haines Road, with little duplication of parties in each direction. On the assumption that each tourist is diverted to the proposed road and spends one extra full day in the Yukon, this would imply an additional 30,000 tourist days spent in the Yukon. Growth in tourism would increase this potential at some 10 percent per year.

Such an occurrence is extremely unlikely, however, for two principal reasons:

(i) The diversion involves only another 40 miles of travelling distance over using the Haines Road, and it is most unlikely that diverted parties would add a full extra day to their trip in the Yukon.

(ii) Superficially, some diversion of tourists to the proposed road seems probable because tourists tend to make the northern tour as a "once-in-a-lifetime" proposition, and surely Whitehorse is of sufficient interest to attract tourists. This is indeed true, and evidence indicates that almost 90 percent of tourists currently visit Whitehorse. Paradoxically, however, this is exactly why little diversion to the Skagway-Carcross Road would probably take place. Almost all visitors go to Whitehorse anyway, and there exists a serious reluctance on their part to visit the same place twice if another routing is available.

The latter conclusion was substantiated by representatives of the major tour operator now using the Alaska Highway to Alaska Mainland to Haines routing for tours, who said that they would continue to use this route regardless of a road between Whitehorse and Skagway. In their opinion, tourists would not want to visit Whitehorse twice. Also, the Haines Road is advertised in Government and other tourist literature as being very scenic – a fact which alone will induce tourists to travel that route. Officials of other

tour companies held essentially the same opinion. In addition to these opinions, representatives of these companies said they would continue to place tourist parties on the White Pass and Yukon Corporation Railway, even if there were a road between Whitehorse and Skagway. The railway trip is itself a significant tourist attraction.

In conclusion, it appears that while some diversion of tourist traffic to the Skagway-Carcross Road might take place, this diversion would not significantly alter present tourist travel patterns.

Another possible effect of the Skagway-Carcross Road might be the diversion and extension of the day rail trips currently taken by visitors from the cruise ships at Skagway. With a road, it would be possible for these visitors to proceed by bus all the way to Whitehorse, rather than just to Carcross or Bennett as they are presently doing on the railway. Those who would normally visit Bennett, and who might continue into the Yukon, would represent additional tourists to the Yukon. Some 6,110 passengers made the round trip from Skagway to Bennett in 1966.

However, as previously mentioned, the narrow-gauge rail trip is considered an important attraction and in the opinion of the cruise operators, would continue to attract the majority of tourists. On the other hand, even if all these tourists did go to Whitehorse, an unlikely event, their impact would only be felt for part of the day.

(b) Resident and Non-Tourist Traffic

In addition to possible benefits from tourism, cost savings could be realized by residents of the Yukon and other business travellers as a result of building the Skagway to Carcross Road. It may also be expected that non-tourist traffic would increase between Skagway and Whitehorse. At present, only some 1,400 non-tourist passengers are carried by the White Pass railway in each direction in a year.

Realistic measurements of changes in non-tourist traffic patterns between Skagway and Whitehorse are difficult to make. The following, however, are some considerations:

(i) There would certainly be an increase of interchange of expenditures between the two communities. More Skagway residents would visit Whitehorse, and more Whitehorse residents would visit Skagway. Since there are some seven times the number of people living in Whitehorse as Skagway, on balance this effect would probably yield a net benefit to Skagway.

(ii) As a result of the road access, it is highly probable that the number of overnight visits between the two communities made by those who travel anyway, would be reduced. At present, a businessman from Whitehorse when visiting Skagway will usually have to stay overnight at Skagway because of the train schedules. .The same applies to the Skagway visitor to Whitehorse. The road would comfortably permit a visit to be accomplished within a day.

(iii) Considering the recreational benefits for Whitehorse residents resulting from easier access to the ocean, the extensive system of rivers and lakes now available to the people of Whitehorse suggests that the ocean would have limited additional appeal.

(iv) Whitehorse would probably evolve as an attractive shopping centre for the people of Skagway, which would tend to benefit the Yukon city. Haines residents would also have shorter access to Whitehorse. However, the benefits which might be realized here are, of course, limited by Customs regulations of both countries.

4.2 Construction of Rail Extension from Macrae to Ross River Area

1. Route Location and Costs

The question of developing an all-rail route from tidewater in Alaska into the Yukon interior has arisen in a number of contexts. One of these related to the possible construction of a railroad to Crest Exploration's massive Snake Rive iron ore deposit. This route was studied during the winter of 1964-65 by the Canadian National Railways on behalf of the Department of Indian Affairs and Northern Development and Crest Exploration Ltd. This study envisaged a 580 mile railroad based on the construction of a tidewater port at Dyea, at the mouth of the Taiya River. Capital costs of such a railroad, including rolling stock would have been in excess of $300 million and perhaps as high as $500 million. A tunnel under the Coast Mountains, which would have been 11 miles long, would itself have cost $18-20 million. Further thought of building such a railroad is now in abeyance because, although the Crest iron ore deposit has a good long term prospect for development, it is not likely to begin production in the short to medium term future. A major railroad capable of handling of at least 5,000,000 tons per year is, therefore, not likely to be required for some time.

More recent consideration has been given to the question of extending a railroad into the Yukon interior in the specific context of this study. An examination has been made of the feasibility of extending a railroad from Whitehorse (Macrae) to Ross River, the only mining area which may be capable of generating volumes high enough to justify the high capital costs of a railway in the near

future. This railroad was visualized as being a narrow gauge (36 inch) line on a standard gauge (56½ inch) roadbed so that it could tie in with the existing White Pass Railroad and it would be relatively inexpensive to convert to standard gauge should the need arise. The rail extension was seen as running from the present White Pass and Yukon railway siding at Macrae to a terminal on the south side of the Pelly River, 16 miles from the Anvil Mining Company's lead-zinc deposit. A mine such as Anvil could shuttle ore concentrates to this terminal by truck.

With the assistance of a professional engineer experienced in railway maintenance planning and operation, a preliminary location for the proposed rail extension was made, capital costs of construction were estimated, and operating conditions and expense estimates were formulated.

It should be understood that the terms of reference of this study did not permit the time nor the budget to conduct a detailed engineering location study or economic analysis of the proposed rail extension. Therefore, it was necessary to develop a preliminary location plan based on existing surveys and data pertinent to the area under consideration. The principal source material, other than published government topographical maps, used for the location work was the C.N.R. study of a possible railway from Dyea, at tidewater, to the Crest iron deposit at Snake River, mentioned earlier; the report of the United States Army Corps of Engineers to the War Department of the United States Government on a proposed location for a Trans Canadian Alaska Railway from Prince George, British Columbia to Fairbanks, Alaska; and maps and highway location surveys prepared by the Federal Department of Public Works in Whitehorse.

The general route of the proposed rail extension was seen as running north from Macrae siding on the White Pass and Yukon railway to a point about 109 miles north of Whitehorse, where it would cross the Yukon River near the junction of the Yukon and Little Salmon Rivers, and would proceed eastward along Little Salmon River, Little Salmon Lake and Magundy River. From this watershed it would cross to the Pelly River Valley to an area west and downstream from the junction of the Lapie River and the Pelly River. The length of this proposed route would be approximately 215 miles. Maximum gradient southbound, the primary direction of haul would not exceed 0.8 per cent.

An estimate of the capital costs of building the proposed railway was prepared. The basic railway right-of-way was specified as 215 miles of main track – 100 lb. rail; 10 miles of passing tracks and terminal "Y"'s or loops – 100 lb. rail, and 15 miles of yard tracks and service sidings – 85 lb. rail. The cost of this rail line was estimated at $48,362,000. In addition, there would be a requirement for maintenance of way equipment; shops, engine and

car facilities; station and roadway buildings; and communications facilities. Total costs are given below:

(1) Roadbed, Bridges, Tunnels, Track and Ballast	$48,362,000
(2) Maintenance of way equipment	390,000
(3) Shops, Engine and Car Facilities	2,000,000
(4) Station and Roadway Buildings	300,000
(5) Communication System	570,000
Total Capital Cost (excluding motive power and rolling stock)	$51,622,000

2. Commodity Traffic Routing

This alternative assumed that principal resource outbound movements would be as follows when the railway was operating.

By Truck:

Anvil to Railway Extension Terminus on South side of the Pelly River.
Clinton Creek to Whitehorse.
United Keno Hill to Whitehorse.
New Imperial Mines to Macrae.
Cassiar to Whitehorse.

By Train:

Clinton Creek, United Keno Hill, Cassiar and New Imperial Mines from Whitehorse (or Macrae) to Skagway.
Anvil from Rail Extension Terminus to Skagway.

Inbound traffic to each mine would move as backhaul along the same routing.

No significant changes in passenger traffic are anticipated with this alternative.

4.3 Construction of Cut-off Roads based on Haines Road – Alaska Highway Route

1. General

Skagway is currently the major tidewater terminal for freight moving to and from the Yukon but the Haines Road-Alaska Highway route, terminating at Haines, Alaska, provides an existing alternative. The Haines Road branches from the Alaska Highway at Haines Junction. Its length is 165 miles, of which 71 miles lie in the Yukon, 50 miles lie in British Columbia, and 54 miles lie in

Alaska. The road was built during World War II as part of the Northwest Highway System. Since the winter of 1963-64 it has been kept open as a year round road whereas previously it had been kept open during summer months only.

Currently, a main use of the Haines Road is providing communications between the Alaska Panhandle and Alaska Peninsula. Haines is a northern terminus of the Alaska State Ferry System, the "marine highway", which serves the main communities of the Panhandle. The Haines Road and Alaska Highway west of Haines Junction comprise the only surface transport link between the two major parts of Alaska.

The Haines Road-Alaska Highway route does not at present provide a competitive alternative for the outhaul of resources from the Yukon and northern British Columbia. For most known and likely mineral occurrences, it lies too far to the west and is at a considerable cost disadvantage to the Skagway route. However, if marketable mineral deposits were found in the far western part of the Yukon, the Haines Road could provide a logical means of outhaul.

The Haines Road cannot be expected to provide any solution to traffic problems which could develop on the Yukon road system if major mines such as Anvil go into production. However, the construction of two "cut-off" roads which would tie in with the Haines Road system has been proposed and each of these must be examined in relation to such problems.

2. Proposed Cut-off Routes – Location and Costs

One of these "cut-off" roads would link Montague on the Mayo Road, 26 miles south of Carmacks, with Champagne on the Alaska Highway, 42 miles east of Haines Junction. The other cut-off would connect Champagne with Klukshu, 42 miles south of Haines Junction on the Haines Road. The distance from the Anvil Mine at Ross River to Haines via the existing road system and the Carmacks-Ross River Road now under construction is 490 miles. Construction of the Montague-Champagne cut-off only would reduce this distance to 440 miles. Construction of the Champagne-Klukshu cut-off would reduce the distance to 445 miles. Construction of both cut-off routes would reduce the overall distance to 395 miles, or by about 20 per cent of the present length.

Only the Montague-Champagne cut-off would provide relief if large mineral volumes were to place a strain on the Territorial road system. Assuming that this route was economically attractive to resource outhaul, it would siphon trucks off the main territorial roads just south of Carmacks. Trucks from the Anvil Mine would then use the Mayo road only between Carmacks and Montague, a distance of 26 miles.

The cost of building the 75 mile Montague-Champagne cut-off has been estimated by the Department of Public Works at

$2,945,000. The 39 mile Champagne-Klukshu cut-off would cost $1,800,000. These costs are not excessive in comparison with proposed routes like the Skagway-Carcross Road and the investment could be worthwhile if the cut-offs were used as resource outhaul routes.

3. Commodity Traffic Routing

This alternative was evaluated with two main traffic flow assumptions. In one case it was assumed that resource output from the Ross River area (Anvil) was moved to Haines, and in the other case Anvil output was assigned to Skagway via Whitehorse. In the former, with the cut-off road from Montague to Klukshu the traffic movements were as follows:

By Truck:

Anvil to Haines
Clinton Creek to Whitehorse
United Keno Hill to Whitehorse
New Imperial Mines to Whitehorse
Cassiar to Whitehorse

By Train:

Clinton Creek, United Keno Hill, Cassiar and New Imperial Mines from Whitehorse to Skagway

Inbound traffic to each mine would move as backhaul along the same routing.

No changes in passenger traffic are anticipated.

4.4 Construction of Railway from Haines to Ross River Area

1. Route Location and Costs

The possibility of building a railway connecting the Yukon interior with Haines has been raised on a number of occasions. A comment on its feasibility is therefore appropriate.

There have been no location surveys made to find a suitable rail route from Haines to the Yukon interior, so even the assumption that such a railway could be built is speculative. In the study of a rail route to the Snake River iron deposits prepared by the C.N.R., a possible Haines route was dismissed. The following excerpts from the C.N.R. report concerning the route are pertinent.

"This route is unfavorable geologically."

"A tunnel along this route would pass through some granodiorite, but mostly through limestone, shale, slate, schist, and basalt, the latter partly altered to serpentine. Serpentine,

schist and shale consist mainly of the soft, slippery, treacherous minerals previously mentioned and could present major difficulties. Limestone, though relatively competent, is easily soluble and often contains large open water courses which in this climate would carry large amounts of water. Such water caused serious trouble during the construction of some of the Alpine tunnels in Europe."

"Also, the Chilkat Valley is known to be the locus of extensive faulting parallel to the valley and therefore, parallel to the proposed tunnel route."

"Unless this route offered some very important economic advantages, or could be laid out so as to require very little tunnelling, it should be avoided."

The economics of a possible Haines-Yukon interior rail route can be further tested by comparing it with the proposed rail extension to the Ross River region, which has been previously described. A railway joining Ross River with Haines would be about 375 miles long, compared with 319 miles for the proposed Ross River extension. Using the same order of magnitude cost estimates ($240,000 per mile) for the proposed Haines railway as was used for the proposed rail extension, the comparative capital costs would be as follows:

	New Construction	Upgrading	Total Cost
Skagway – Ross River	$51,622,000	$2,770,000	$54,392,000
Haines – Ross River	76,560,000	–	76,560,000

With the Haines railway route requiring $22,000,000 more capital, or 40 per cent more than the Skagway rail route, and the resulting rail haul being 56 miles or close to 20 per cent longer than the Skagway route, it is considered that the economics of the Skagway route would be much more favourable. Hence for technical and economic reasons, the proposed rail route to Haines should not be considered further as a feasible alternative.

Part V ECONOMICS OF ALTERNATIVES

5.1 Overall Economics

As outlined in the introduction to this Summary report, ten major changes in the transport system were considered. The two based on Tarr Inlet and Juneau were dismissed as clearly less attractive than the others. The remaining changes are represented in three of the Alternatives described in Part IV and the Alternative of the present system with upgrading of the White Pass and Yukon Railway. These Alternatives were analysed in great detail. The possibility of a rail extension out of Haines was not considered worthy of detailed examination.

The four important Alternatives are as follows:

1. Construction of a new highway from Skagway to Carcross, and upgrading of the highway from Macrae to Carcross.
2. Construction of a railway extension from Macrae to the Ross River area.
3. Construction of new highway from Montague to Klukshu (with traffic as described above in 4.3, part 3).
4. Present roads with upgrading of the White Pass and Yukon Railway.

Each Alternative was considered as a total transportation system for present and future Yukon-tidewater traffic. Traffic volumes by commodity classification and by direction were estimated for a base year of 1966 and for each year up to 1982. The operating requirements in terms of fixed plant and equipment were established. The method of movement, routing characteristics, capital and operating costs were then developed for each Alternative for each year.

By such an analytical process (or "model") of each Alternative, the total cost (less estimated benefits) for all traffic movements in each year was estimated. This cost represents the cost to all participants in the Yukon economy for moving commodities between the Yukon and tidewater.

One economic measure of each Alternative is termed the annual equivalent cost of the system. The annual equivalent cost measures the "average" annual transportation cost to the economy, taking into account the timing of expenditures and benefits in future years. The most economical system will be the one which provides required transportation services to the economy at the lowest annual equivalent cost. The following table shows the annual equivalent costs for each Alternative.

Annual Equivalent Costs
Alternative Transportation Systems

	Annual Equivalent Cost at Assumed Interest Cost on Capital		
	0%	5% ($000)	10%
Present roads with upgrading of White Pass and Yukon Railway	14,000	15,200	15,400
Construction of Montague-Klukshu Road	15,500	16,600	16,800
Construction of Skagway-Carcross Road	15,200	16,800	17,400
Construction of Railway from Macrae to Ross River Area	15,400	17,700	19,400

The foregoing tabulation means that the present roads with upgrading of the White Pass and Yukon Railway will be the most economical transportation system for the forecast traffic volumes and routing.

5.2 Skagway-Carcross Road

While there could be various economic advantages as a result of the proposed Skagway-Carcross road, the principal possible benefits would be associated with the movement of resources out of the Yukon over the road.

Analysis of trucking costs shows that the Skagway-Carcross road would offer lower costs for movements to tidewater at Skagway than the proposed Montague-Klukshu road to Haines for most of the existing and potential Yukon mine output. This is simply a matter of the mileage between Haines or Skagway and the Yukon mine sites.

However, the possible commodity movement advantages of the road over the present road-rail system would be microscopic (if they in fact would exist) for most Yukon mines, although large road capital expenditures and heavy additional road maintenance costs would be incurred.

As previously described, no significant increase in tourist traffic could be anticipated. There would, however, be some cost savings to Yukon residents. Some 1,000 return rail trips per year are taken by Whitehorse residents. The existing rail fare is $35.00 return. On the assumption that a bus would be available at $10.00 return fare, which seems reasonable, a saving of some $25.00 each trip would be realized in transportation user costs.

Another possible source of cost savings benefits to Yukon residents could perhaps arise from the inhaul by truck of foodstuffs

and other consumer goods. Considered alone the direct trucking costs for such commodities would be less than the rates charged by the White Pass and Yukon Railway. However, this limited comparison does not reflect the whole situation. A competitive operator would either have to ship commodities from Vancouver with his own equipment or would have to use the White Pass and Yukon ship and then tranship at Skagway.

It appears extremely unlikely that a competitive operator could move general commodities northbound from Vancouver to Whitehorse at a rate lower than the White Pass and Yukon Corporation if he had to use his own shipping facilities. The low volume of traffic, the provision of port facilities and the empty backhaul movement would be crippling. If he used the White Pass and Yukon ship and then transhipped to trucks at Skagway, he would incur unloading, transhipping, storage and loading costs at Skagway, as well as transhipping costs at Whitehorse.

The foregoing are some of the main reasons why construction of the Skagway-Carcross road does not offer economic advantages over the alternatives. Further, another important factor weighing against construction of the route is that building it would do nothing to relieve congestion which could occur on the Yukon-tidewater transport system if mineral volumes rise significantly beyond currently forecast levels. In time a modification of the Yukon's internal transport system might be necessary even if the new tidewater road were developed. Considering that development capital for the north is already quite limited in supply, and that a rational approach requires that it be invested where it will do most good in furthering economic growth, it would not seem reasonable to invest an expenditure of about $20 million on the proposed route in view of the limited advantages it offers.

5.3 Montague-Klukshu Road

Construction of the Montague to Klukshu cut-off road is not recommended. The route to Haines could not provide a lower cost outhaul than routes based on Skagway for any of the existing or proposed mines in the Yukon.

5.4 Railway Extension – Macrae to Ross River Area

At presently forecast traffic volumes an all-rail haul would provide the lowest transportation costs from the Ross River area to tidewater if the interest cost on the large amount of capital which would be required is not included. However, when the interest cost of capital is included, the all-rail costs are higher than any of the alternative highway-rail alternatives.

This alternative does not offer the most economical transportation system because the forecast volume of outbound resource traffic is insufficient to offset the high capital requirements. However, if outbound volumes from mines such as Anvil should rise substantially, or if another major mine were to come into production in the Ross River area, the all-rail movement of concentrates to tidewater could become competitive with the road-rail alternative presently envisaged. In other words, if the outbound volumes from the Ross River area were to increase by approximately 80% from their presently forecast levels, or to a volume of some 750,000 tons annually, the rail extension would probably provide the most economical alternative.

The main advantage in having a railway extending into the Yukon interior is that it would provide the cheapest form of transportation for outgoing high volume bulk resources and thereby enhance their competitive position in world markets. However, a very important secondary benefit from such a facility is that it can become a catalyst to further development in the mining industry and indeed could attract investment in other resource industries such as the forest industry.

Another important advantage of an all-rail system is that future resource movements would not place a strain on the Territorial road system. The road system would still be used for the outhaul of some resources (for example, it is likely that asbestos from Clinton Creek would continue to be trucked to Macrae even if a railroad were built to the Ross River area), but trucking volumes would not be so high as to seriously interfere with normal traffic. The road system could continue to function partly as a resource gathering system, but would function mainly to accommodate local and tourist automobile traffic.

From the standpoint of employment in the Yukon, it is true that a railroad would employ fewer persons than a trucking operation in handling traffic volumes of around 750,000 tons. However, it is not considered that the development of a railroad extension would result in a net decline in employment in the Yukon.

Finally, a rail extension would also have an added beneficial influence on employment in the Whitehorse area as a result of the likely shift in the centre of operations of the White Pass and Yukon Railway from Skagway to Whitehorse.

APPENDIX A
STATISTICAL INFORMATION

Table 1

MOVEMENT OF COMMODITIES SOUTHBOUND FROM THE YUKON TO TIDEWATER*

Origin	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975 Forward
					(Thousand tons of concentrate)					
New Imperial – Copper	–	15	30	30	30	30	30	30	30	30
United Keno Hill – Lead, Zinc, Silver	24	20	10	5	–	–	–	–	–	–
Clinton Creek – Asbestos	–	10	60	70	70	80	100	120	120	120
Cassiar – Asbestos	80	80	80	80	80	80	80	80	80	80
Anvil – Lead, Zinc	–	–	–	–	380	380	400	400	420	420

*Some 1200 tons of miscellaneous commodities were shipped southbound out of Whitehorse in 1966. These are not included above.

Source: 1966 figures are actual. Projections are estimates based on discussions with the respective company officers.

Table 2

MOVEMENT OF COMMODITIES AND PETROLEUM PRODUCTS NORTHBOUND FROM TIDEWATER TO THE YUKON (THOUSANDS OF TONS)

Destination	1966		1967		1968		1969		1970	
	Comm.	P. Prod.	Comm.	P. Prod.	Comm.	P. Prod.	Comm.	P. Prod.	Comm.	P. Prod.
Whitehorse	23.2	37.3	23.2	37.3	23.2	37.3	23.2	37.3	23.2	37.3
Carcross	0.3		0.3		0.3		0.3		0.3	
East of Whitehorse	0.1	10.6	0.1	11.1	0.1	11.6	0.1	12.1	0.1	12.6
Cassiar	2.0	13.3	2.0	13.3	2.0	13.3	2.0	13.3	2.0	13.3
West of Whitehorse	0.4	6.0	0.4	6.3	0.4	6.6	0.4	6.9	0.4	7.2
Mayo Rd. S. & Incl. Carmacks	0.1	0.6	0.1	0.6	0.1	0.6	0.1	0.6	0.1	0.6
Mayo & Dawson Rds. N. of Carmacks & Ross River – Carmacks Rd.	1.3	8.9	1.3	8.9	1.3	8.9	1.3	8.9	1.3	8.9
Clinton Creek Mines	7.8	1.0	2.5	6.6	5.0	13.2	5.0	13.3	5.0	13.4
Keno Hill Mine	1.7	1.5	1.6	1.4	0.9	0.6	0.4	0.1	–	–
Anvil*	0.5	2.0	0.5	2.0	23.0	3.0	26.0	6.0	18.0	21.4

(Continued)

Table 2 (continued)

MOVEMENT OF COMMODITIES AND PETROLEUM PRODUCTS NORTHBOUND FROM TIDEWATER TO THE YUKON (THOUSANDS OF TONS)

Destination	1971		1972		1973		1974		1975	
	Comm.	P. Prod.	Comm.	P. Prod.	Comm.	P. Prod.	Comm.	P. Prod.	Comm.	P. Prod.
Whitehorse	23.2	37.3	23.2	37.3	23.2	37.3	23.2	37.3	23.2	37.3
Carcross	0.3		0.3		0.3		0.3		0.3	
East of Whitehorse	0.1	13.1	0.1	13.6	0.1	14.1	0.1	14.6	0.1	15.1
Cassiar	2.0	13.3	2.0	13.3	2.0	13.3	2.0	13.3	2.0	13.3
West of Whitehorse	0.4	7.5	0.4	7.8	0.4	8.1	0.4	8.4	0.4	8.7
Mayo Rd. S. & incl. Carmacks	0.1	0.6	0.1	0.6	0.1	0.6	0.1	0.6	0.1	0.6
Mayo & Dawson Rds. N. of Carmacks & Ross River – Carmacks Rd.	1.3	8.9	1.3	8.9	1.3	8.9	1.3	8.9	1.3	8.9
Clinton Creek Mine	5.0	13.5	5.0	13.6	5.0	13.7	5.0	13.8	5.0	13.9
Keno Hill Mine	–	–	–	–	–	–	–	–	–	–
Anvil*	18.0	21.4	18.0	21.4	18.0	21.4	18.0	21.4	18.0	21.4

* Excludes diesel fuel requirements for trucking operation which will range between 2,700 tons and 5,600 tons depending on which highway route is used.

Table 3

NUMBER OF PEOPLE ENTERING THE YUKON AT U.S. – CANADIAN BORDER CROSSING POINTS

	Mile 1202			Dawson			Haines		
	1964	1965	1966	1964	1965	1966	1964	1965	1966
January	1,346	1,479	1,486	–	–	–	379	495	538
February	1,348	1,204	1,297	–	–	–	321	530	505
March	1,471	1,611	1,913	–	–	–	331	696	592
April	3,025	1,834	2,040	–	–	–	550	949	925
May	5,843	4,784	5,698	–	–	127	1,202	1,827	1,711
June	7,602	9,328	11,109	394	495	743	2,609	3,030	3,492
July	11,860	14,855	16,732	1,540	1,722	2,469	3,939	4,872	5,376
August	10,793	12,823	15,355	1,493	1,941	2,085	3,455	4,279	4,793
September	4,996	6,254	6,746	364	464	420	1,784	1,995	1,935
October	3,508	4,147	3,845	–	24	52	996	916	878
November	2,465	2,654	2,658	–	–	–	618	517	507
December	2,368	2,829	2,553	–	–	–	488	584	534
Year	56,625	63,802	71,432	3,791	4,646	5,896	16,672	20,690	21,786

Source: Department of Travel and Publicity for the Yukon based on Canadian Customs' Figures.

Table 4

ESTIMATED NUMBER OF TOURIST AND BUSINESS VISITORS ENTERING THE YUKON AT U.S. – CANADIAN BORDER CROSSING POINTS 1966

	M.P. 1202			Dawson			Haines			Skagway to Whitehorse*		
	All Visitors	Business and Local	Tourists	All Visitors	Business and Local	Tourists	All Visitors	Business and Local	Tourists	All Visitors	Business and Local	Tourists
January	1,486	1,486	–	–	–	–	538	538	–	29	29	–
February	1,297	1,297	–	–	–	–	505	505	–	41	41	–
March	1,913	1,913	–	–	–	–	592	592	–	33	33	–
April	2,040	1,900	140	–	–	–	925	700	225	166	100	66
May	5,698	2,200	3,498	127	27	100	1,711	750	961	246	125	121
June	11,109	2,700	8,409	743	143	600	3,492	820	2,672	1,465	250	1,215
July	16,732	3,000	13,732	2,469	269	2,200	5,376	910	4,466	2,629	339	2,290
August	15,355	2,850	12,505	2,085	185	1,900	4,793	870	3,923	2,290	288	2,002
September	6,746	2,750	3,996	420	120	300	1,935	640	1,295	550	150	400
October	3,845	2,700	1,145	52	52	–	878	550	328	52	52	–
November	2,658	2,658	–	–	–	–	507	507	–	22	22	–
December	2,553	2,553	–	–	–	–	534	534	–	19	19	–
Year	71,432	28,007	43,425	5,896	796	5,100	21,786	7,916	13,870	7,542	1,448	6,094

Source: Estimated from data supplied by the Department of Travel and Publicity, Whitehorse Yukon and from data supplied by the White Pass and Yukon Railway.

*Note: The northbound Skagway to Whitehorse figures include both one-way and round-trip passengers.

Table 5

ALL PASSENGERS CARRIED BY WHITE PASS & YUKON CORPORATION RAILWAY

Year	Northbound	Southbound	Total
1960	9,117	8,792	17,909
1961	11,140	11,102	22,242
1962	12,451	12,211	24,662
1963	14,915	14,197	29,112
1964	14,833	13,925	28,758
1965	16,365	15,273	31,638
1966	21,879	20,143	42,022

Source: White Pass & Yukon Records.

Table 6

NUMBER OF VISITORS ENTERING THE YUKON AT U.S. – CANADIAN BORDER CROSSING POINTS BY BUS

	1964	1965	1966
January	13	11	46
February	75	30	85
March	33	141	4
April	12	46	17
May	69	251	63
June	460	510	855
July	1,301	1,296	1,929
August	786	1,178	1,783
September	185	245	447
October	32	50	26
November	18	36	9
December	18	10	11
Year	3,002	3,804	5,275

Source: DBS Travel Between Canada, United States and Other Countries.

Table 7

NUMBER OF NON-COMMERCIAL VEHICLES ENTERING THE YUKON AT U.S. – CANADIAN BORDER CROSSING POINTS*

	Mile 1202		Dawson		Haines		Carcross	
	1965	1966	1965	1966	1965	1966	1965	1966
January	433	470	–	–	59	73	3	1
February	377	384	–	–	55	64	6	4
March	444	648	–	–	72	98	4	9
April	563	593	–	–	130	119	4	6
May	1,355	1,591	–	63	150	179	14	22
June	2,669	2,885	184	279	609	603	44	90
July	4,215	5,151	680	882	1,062	1,132	140	186
August	4,018	5,011	741	813	892	1,271	87	144
September	2,278	2,494	205	182	615	727	6	36
October	1,514	1,544	8	14	239	206	1	6
November	929	994	–	–	96	113	5	6
December	914	844	–	–	76	70	1	–
Year	19,709	22,609	1,818	2,233	4,055	4,655	315	510

Source: DBS Travel between Canada, United States and Other Countries and the Records of the White Pass and Yukon Railway.

*Note: Includes vehicles entering the Yukon for more than 24 hours.

Table 8

ONE-WAY HIGHWAY MILEAGES BY ALTERNATIVE ROUTES

Highway Segment	Mlge.	Anvil to Macrae	Anvil to Skag.	Anvil to Haines via Alaska Hwy. to Haines J.	Anvil to Haines via Alaska Hwy. to Champagne	Anvil to Haines via Montague-Champagne-Haines J.	Anvil to Haines via Montague-Champagne-Klukshu	New Imp. to White.	New Imp. to Macrae	New Imp. to Shag.	Clinton Creek to White.	Clinton Creek to Skag.	Clinton Cr. to Haines via Champ.-Klukshu	Keno to White.	Keno to Skag.	Cassiar to White.	Cassiar to Skag.
Clinton Creek to Dawson City	62										62	62	62				
Dawson City to Stewart Crossing	113										113	113	113				
Keno Hill to Stewart Crossing	64													64	64		
Stewart Crossing to Carmacks	110										110	110	110	110	110		
Anvil to Ross River Road	16	16	16	16	16	16	16										
Ross River Road to Carmacks	110	110	110	110	110	110	110										
Carmacks to Montague	26	26	26	26	26	26	26				26	26	26	26	26		
Montague to MP 926 Alaska Hwy.	76	76	76	76	76						76	76		76	76		
Montague to Champagne	75					75	75						75				
MP 926 Alaska Hwy. to Champagne	49			49	49												
MP 926 Alaska Hwy. to Whitehorse	8	8	8								8	8		8	8		
Whitehorse to Macrae	7	7	7									7			7		
Champagne to Haines Junction	42			42		42											
Champagne to Klukshu	39				39		39						39				
Haines Junction to Klukshu	42			42		42											
Klukshu to Haines	122			122	122	122	122						122				
Haines to Lutak Inlet	7			7	7	7	7						7				
Cassiar to MP 650 Alaska Hwy.	89															89	89
MP 650 Alaska Hwy. to Jake's Cr.	217															217	217
Jake's Cr. to Whitehorse	51															51	
New Imperial to Macrae	3								3								
New Imperial to Whitehorse	9							9									
New Imperial to Carcross	37									37							
Macrae to Carcross	35		35									35			35		
Jake's Cr. to Carcross	32																32
Carcross to Skagway	61		61							61		61			61		61
TOTAL HIGHWAY MILEAGE		243	339	490	445	440	395	9	3	98	395	498	554	284	387	357	399

Table 9

DISTRIBUTION OF HIGHWAY ROUTE MILES BETWEEN YUKON, BRITISH COLUMBIA AND ALASKA

Highway Route	HIGHWAY MILEAGES			
	Yukon	B.C.	Alaska	Total
1. Anvil to Macrae	243	–	–	243
2. Anvil to Skagway	295	32	12	339
3. Anvil to Haines via Alaska Hwy. to Haines Junction	386	50	54	490
4. Anvil to Haines via Alaska Hwy. to Champagne-Klukshu	341	50	54	445
5. Anvil to Haines via Montague-Champagne-Haines Junction	336	50	54	440
6. Anvil to Haines via Montague-Champagne-Klukshu	291	50	54	395
7. New Imperial Mines to Whitehorse	9	–	–	9
8. New Imperial Mines to Macrae	3	–	–	3
9. New Imperial Mines to Skagway	54	32	12	98
10. Clinton Creek to Whitehorse	395	–	–	395
11. Clinton Creek to Skagway	454	32	12	498
12. Clinton Creek to Haines via Montague-Champagne-Klukshu	450	50	54	554
13. Keno Hill to Whitehorse	284	–	–	284
14. Keno Hill to Skagway	343	32	12	387
15. Cassiar to Whitehorse	268	89	–	357
16. Cassiar to Skagway	266	121	12	399

Table 10

ESTIMATED COST OF WHITE PASS & YUKON RAILWAY TRACK UPGRADING PROGRAM TO PERMIT HANDLING OF 600,000 TONS PER YEAR

Improve drainage	Lump Sum	$ 20,000
Bank widening	Lump Sum	14,600
Gravel Ballasting & Surfacing – 110 miles, 220,000 cu. yds.	@ 4.00	880,000
New 100 lb. rail 20 track miles 3,520 net tons	@ 170.00	598,400
New Joint Bars – 5,600 pairs	@ 5.00	28,000
New Bolts – 22.4 tons	@ 400.00	8,960
New Lock Washers – 22,400	@ .20	4,480
New Spikes – 20 tons account wastage	@ 300.00	6,000
New Tie Plates for New Rail – 120,000	@ 1.10	132,000
72 lb. Second hand Tie Plates – released from new rail area serviceable 100,000	@ No Cost	–
New Tie Plates to complete tie Plating, exclusive of above 350,000 punched for 100 – 72 lb. and 100 – 65 lb. rail	@ 1.20	420,000
Additional New Rail Anchors – 70,000	@ 65	45,500
New Untreated No. 3 Ties account ballasting 20,000	@ 3.00	60,000
New 100 lb. Turnouts – complete – 6	@ 1,500.00	9,000
Compromise Joints – 12	@ 50.00	600
Labour – Install 20 miles New Rail	@ 3,000.00	60,000
Labour – Install 570,000 Tie Plates, 70,000 Rail Anchors and 6 New Turnouts		84,800
Estimated Cost of Replacing 5 miles 56 lb. and 45 lb. Worn Rail in Sidings, using released 72 lb. rail and fastenings from Main Track:		
Rail, Joint Bar, Bolts, Washers, Tie Plates & Anchors – No Cost		–
Labour – Install 5 miles rail in sidings	@ 2,000.00/mile	10,000
Labour – Install 20,000 Tie Plates, 1,200 Rail Anchors & 6 Turnouts in Terminal		6,000
		$2,388,340
New Yard Tracks at Macrae – Total 1 mile using released rail & fastenings from Main Track		45,000
		$2,433,340
Supervision and Contingencies		246,660
TOTAL		$2,680,000
Mechanized Track Machines required to maintain surface and line – 1 Automatic Tamper and 1 Liner for Narrow Gauge Track.		90,000
		$2,770,000

Table 11

ESTIMATED COST OF WHITE PASS & YUKON RAILWAY TRACK UPGRADING PROGRAM TO PERMIT THE HANDLING OF 2,000,000 TONS PER YEAR

All improvements shown in Table 10 (for handling 600,000 tons) PLUS THE FOLLOWING:			
Additional Gravel Ballasting and Surfacing Crushed & Screened – 150,000 cu. yds.	@	5.00	$ 750,000
New 100 lb. rail – 90 track miles – 15,840 net tons	@	170.00	2,692,800
New Joint Bars – 25,200 pairs	@	5.00	126,000
New Bolts – 100.8 tons	@	400.00	40,320
New Lock Washers – 100,000	@	.20	20,000
Track Spikes – account wastage – 90 tons	@	300.00	27,000
New Tie Plates for 100 lb. – 200,000	@	1.10	220,000
Rail Anchors – 80,000	@	.65	52,000
Additional Ties No. 3 Untreated – account ballasting & to adjust tie spacing to maximum 21" – 30,000	@	3.00	90,000
New Turnouts – 8 – 100 lb.	@	1,500.00	12,000
Compromise Joints – 24	@	50.00	1,200
Labour – Install 90 miles New Rail	@	3,000.00	270,000
Labour – Install 200,000 tie plates, 80,000 rail anchors, 8 turnouts			31,600
Construct 2 miles additional siding & yard tracks using new ties, second hand rail & fastenings released from Main Track			100,000
Upgrade 5 miles siding and terminal tracks using released rail and fastenings from Main Track – No Cost			–
Labour – Installing rail & fastenings – 5 miles			20,000
Gravel Ballasting – 10,000 cu. yds.	@	4.00	40,000
			$4,492,920
Supervision and Contingencies			447,080
			$4,940,000
Plus Estimate in Table 10			2,680,000
Total – Estimated Cost to Upgrade Track to handle 2,000,000 tons			$7,620,000
Additional mechanized track machines required to maintain surface and line – Automatic Tamper and Liner			90,000
Additional Small Tools			30,000
TOTAL			$7,740,000

Table 12

ESTIMATED COST OF ROADBED, BRIDGES, TUNNELS, TRACK AND BALLAST – RAIL EXTENSION, MACRAE TO ROSS RIVER AREA

ITEM	UNIT	QUANTITY	UNIT COST	AMOUNT
Clearing & Grubbing	Acres	3,000	$ 200.00	$ 600,000
			TOTAL	$ 600,000
Grading				
Solid Rock	Cu. Yds.	2,000,000	3.50	$ 7,000,000
Other Material	Cu. Yds.	15,000,000	.75	11,250,000
D.M. Permafrost	Cu. Yds.	1,000,000	2.50	2,500,000
Highway Divisions by Fox Lakes	Lump Sum			300,000
			TOTAL	$21,050,000
Tunnels				
Short Tunnels	Lineal Ft.	1,200	300.00	360,000
			TOTAL	360,000
Bridges, Culverts, Protection Against Slides and Crossings				
Timber Bridges	Lineal Ft.	2,600	270.00	$ 702,000
Steel Bridges	Lineal Ft.	2,700	1,400.00	3,780,000
Rock & Snow Sheds	Lineal Ft.	400	1,100.00	440,000
Retaining Walls	Lineal Ft.	500	900.00	450,000
Culverts	Lineal Ft.	70,000	30.00	2,100,000
Rip Rap	Cu. Yds.	40,000	4.00	160,000
			TOTAL	$ 7,632,000
Track				
Ties – Untreated No. 1	No.	645,000	5.10	3,289,500
Ties – Untreated No. 2	No.	75,000	4.50	337,500
Switch Ties – 70 Sets	MFBM	300	130.00	39,000
Rail 100lb. & 85lb.	N. Tons	41,750	170.00	7,097,500
Fastenings	N. Tons	3,200	260.00	832,000
Tie Plates	N. Tons	8,400	175.00	1,470,000
Anchors	No.	4,700,000	.60	282,000
Turnouts	No.	70	2,500.00	175,000
Compromise Joints	No.	50	50.00	2,500
			TOTAL	$13,525,000
Lay Track	Miles	240	7,500.00	1,800,000
Install Turnouts	No.	70	500.00	35,000
Sub-ballast Pit Run	Cu. Yds.	800,000	1.70	1,360,000
Ballast crushed & screened	Cu. Yds.	500,000	4.00	2,000,000
Lay Track, Ballast and Surface			TOTAL	$ 5,195,000
GRAND TOTAL Roadbed, Bridges, Tunnels, Track and Ballast				$48,362,000

Table 13

ESTIMATED CAPITAL COST OF MAINTENANCE OF WAY EQUIPMENT RAILWAY EXTENSION, MACRAE TO ROSS RIVER AREA

Ballast Tampers	2 @	$ 40,000	$ 80,000
Track Liners	1 @	22,000	22,000
Ballast Regulators	1 @	18,000	18,000
Spike Driver	1 @	5,000	5,000
Spike Puller	1 @	3,200	3,200
Bolters	1 @	3,000	3,000
Rail Saw	1 @	900	900
Rail Drills	2 @	900	1,800
Stock Rail Grinder	1 @	1,900	1,900
Bulldozers	2 @	37,000	74,000
Air Compressor	1 @	15,000	15,000
Hand Operated Hoist	1 @	1,200	1,200
Electric Tools for B & B with Generators	1 @	900	900
Portable Generators	2 @	600	1,200
Pumps – Gas Operated	1 @	1,500	1,500
Radios	5 @	1,000	5,000
Power Jack	1 @	5,000	5,000
Shovel Diesel, 1½ Yard with Bucket and Dragline	1 @	100,000	100,000
Trucks – General Purpose	2 @	7,000	14,000
Track Motors – Section and B & B	15 @	1,100	16,500
Track Motors – Supervisors	3 @	1,300	3,900
Push Cars	15 @	400	6,000
Hand Tools			10,000
TOTAL			$390,000

Table 14

ESTIMATED CAPITAL COST FOR RELATED FACILITIES RAILWAY EXTENSION, MACRAE TO ROSS RIVER AREA

Shops, Engine and Car Facilities		
Engine and Car Shop		$1,000,000
Shop Machinery, Drop Table and Tools		650,000
Shop Fueling and Sand Facilities		150,000
On-Line Fueling and Sanding Facilities		200,000
		$2,000,000
Station and Roadway Buildings		
Portable Buildings	25 @ $10,000	$ 250,000
Tool and Motor Car Sheds	20 @ $ 6,000	20,000
Maintenance Garage for Off-Track Equipment		30,000
		$ 300,000
Communications System		
Pole Line and One Pair Wire		$ 300,000
Radio		200,000
Telephone and Carrier Equipment		50,000
Drop Circuits Highway to Railway		20,000
		$ 570,000

Table 15

ESTIMATED CAPITAL COSTS OF CONSTRUCTING A PORT FACILITY FOR 400,000 TONS PER YEAR AT SKAGWAY OR AT HAINES (LUTAK INLET)

	Skagway	Haines
Land Fill	$ 120,000	$ 15,000
Dredging	280,000	50,000
Rock Dredging		30,000
Breakwater & Rip Rap	90,000	20,000
Causeway		22,000
Bulkhead		30,000
Site Work	20,000	20,000
Power & Water	60,000	85,000
Storage Dome	801,000	801,000
Warehouse and Administration	360,000	360,000
Main Pier	507,000	507,000
Trestle	585,000	608,000
Catwalk	78,000	45,000
Breasting Dolphins	30,000	30,000
Ship Puller	60,000	40,000
Conveyors	119,000	85,000
Recovery Tunnel	13,000	12,000
Ship Loader 1000 TPH	135,000	135,000
Tilting Platform		80,000
Car Shaker	20,000	
Conveyor Transfer Point	20,000	30,000
Trackage	50,000	
Lease of Site	10,000	40,000
Miscellaneous	42,000	55,000
Contingencies, and Engineering Fees, etc. (19%)	646,000	588,000
Total	$4,046,000	$3,688,000

Table 16

ESTIMATED UNIT COST FOR CONSTRUCTING A PORT FACILITY FOR 400,000 TONS PER YEAR AT SKAGWAY OR AT HAINES (LUTAK INLET)

	Skagway			Haines		
	Quantity	Unit	Unit Cost	Quantity	Unit	Unit Cost
Landfill	300,000	C.Y.	$0.40	15,000	C.Y.	$1.00
Dredging	350,000	C.Y.	0.80	50,000	C.Y.	1.00
Rock Dredging	–	–	–	10,000	C.Y.	3.00
Breakwater and Rip Rap	900	L.F.	100.00	200	L.F.	100.00
Causeway	–	–	–	150	L.F.	150.00
Bulkhead	–	–	–	100	L.F.	300.00
Site Work	L.S.			L.S.		
Power and Water	L.S.			L.S.		
Storage Dome	30,800	S.F.	26.00	30,800	S.F.	26.00
Warehouse & Administration	20,000	S.F.	18.00	20,000	S.F.	18.00
Main Pier	7,800	S.F.	65.00	7,800	S.F.	65.00
Trestle	13,000	S.F.	45.00	13,500	S.F.	45.00
Catwalk	2,600	S.F.	30.00	1,500	S.F.	30.00
Breasting Dolphins	2	each	15,000.00	2	each	15,000.00
Ship Puller	L.S.			L.S.		
Conveyors	1,400	L.F.	85.00	1,000	L.F.	85.00
Recovery Tunnel	1,300	S.F.	10.00	1,200	S.F.	10.00
Ship Loader 1000 TPH	L.S.			L.S.		
Tilting Platform				1	each	80,000.00
Car Shaker	L.S.					
Conveyor Transfer Point	2	each	10,000.00	3	each	10,000.00
Trackage	2,500	L.F.	20.00	–		
Lease of Site	L.S.			L.S.		

Table 17

ESTIMATED CAPITAL COST OF ENLARGING THE 400,000 TONS PER YEAR FACILITY TO 5,000,000 TONS PER YEAR AT SKAGWAY

'tem and Description	Quantity	Unit	Unit Cost of Material	Total U.S.$
Dredging	700,000	C.Y.	0.75	$ 525,000
Land Fill	200,000	C.Y.	.30	60,000
Rip Rap	L.S.			150,000
Power and Water	L.S.			100,000
Buildings	L.S.			200,000
Pier	45,000	S.F.	65	2,925,000
Conveyors	2,300	L.F.	85	195,000
Recovery Tunnel	4,000	S.F.	15	60,000
Travel Loader	L.S.	(includes tripper)		1,550,000
Car Shaker	L.S.			150,000
Stacker	L.S.			150,000
Conveyor Transfer Point	3	each	20,000	60,000
Trackage	5,000	L.F.	20	100,000
Crusher & Grizzly	L.S.			100,000
Modify ferry terminal & construct a new causeway				200,000
				6,525,000
Plus 19% for contingencies, engineering fees, etc.				1,240,000
1967 Cost of Construction.				$7,765,000

Table 18

ESTIMATED CAPITAL COSTS OF ENLARGING THE 400,000 TONS PER YEAR FACILITY TO 5,000,000 TONS PER YEAR HAINES (LUTAK INLET)

Item and Description	Quantity	Unit	Unit Cost of Material	Total U.S.$
Dredging	100,000	C.Y.	2.50	$ 250,000
Land Fill	50,000	C.Y.	1.00	50,000
Rip Rap	L.S.			50,000
Power & Water	L.S.			100,000
Building	L.S.			200,000
Pier	45,000	S.F.	65	2,925,000
Conveyors	2,000	L.F.	85	170,000
Recovery Tunnel	4,000	S.F.	15	60,000
Travel Loader	L.S.	(includes tripper)		1,550,000
Car Shaker	L.S.			150,000
Conveyor Transfer Point	3	each	20,000	60,000
Trackage	10,000	L.F.	20	200,000
Crusher & Grizzly	L.S.			100,000
				5,865,000
Plus 19% for contingencies, engineering fees, etc.				1,115,000
1967 Cost of Construction.				$ 6,980,000

APPENDIX B
HARBOUR STUDY WITH PHOTOGRAPHIC SUPPLEMENT
PREPARED BY
KELLY, PITTELKO, FRITZ AND FORSSEN
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APPENDIX B

I. Introduction*

At present Skagway, Alaska, is the principal port serving the Yukon Territory. Located at the terminus of the White Pass & Yukon Corporation Railway, Skagway is the ocean gateway for some 120,000 tons of southbound freight annually. Northbound, some 115,000 tons of freight and petroleum products are moved through the port, approximately 70% being petroleum products which proceed either on the railway or via the pipeline to Whitehorse.

Principal users of the Skagway port are:

1. The White Pass & Yukon Corporation ship, the 6,000 ton Frank H. Brown, which is described as a tanker-container vessel, makes regular visits to Skagway from Vancouver every two weeks. The frequency of this schedule will be increased in 1968.
2. The Alaska Ferry Service which makes scheduled visits to Skagway approximately half the days of the week in the winter, and most days during the May to September period.
3. The Canadian National, Canadian Pacific and Westours cruise ships which in 1966 made some 65 visits to Skagway in the May 1st to September 30th period.
4. The tanker ships of the Standard Oil Company which made some 35 visits to Skagway during 1966. These ships deliver gasoline products, most of which are subsequently moved in rail tank cars to Whitehorse.

II. Objectives

The objective of the port study section of this report may be described briefly as follows:

1. To assess the technological feasibility of alternative port sites at or near Skagway or Haines from the viewpoint of terrain, tides, winds, soils, access and so forth.
2. To compare the estimated capital and operating costs that would be incurred at alternative feasible port sites. Primarily, this objective amounts to a comparison of the costs of building and operating a port at Skagway or at Haines.

These objectives were considered in the context of moving some 400,000 tons through the port as a first phase, and some 5,000,000 tons as a second phase.

III. Scope of Study

Four sites for the establishment of a port facility for the storage and loading of ore originating in the Yukon were evaluated, two at Skagway and two at Haines. One site at each of these areas had been recommended by others.

*All costs in this Appendix are in U.S. dollars.

The following parameters have been used to evaluate the sites:

1. Site Conditions

   (a) Topographic and geologic conditions

   (b) Climatic conditions

   (c) Hydrographic conditions

   (d) Necessity for auxiliary work not related directly to the bulk handling facility.

2. Harbour and Shipping Data

3. Costs

   i. Capital cost of facility

   ii. Estimated operating costs for the bulk handling facility.

Preliminary layouts shown at the end of this Appendix and cost estimates (appearing in Appendix A) have been completed for the prime sites at both Skagway and Haines. Emphasis has been placed on the 400,000 tons per year capacity phase. Requirements for a facility to handle 5,000,000 tons per year have been reviewed, but were not developed in detail. Larger volumes, while conceivable, were beyond the scope of this study.

IV. Summary of Findings

Skagway Harbour

It is concluded that a site at Skagway would be entirely suitable for a port of the required scope. The site considered most suitable lies between the existing breakwater and the ferry terminal. It could be developed in two phases, utilizing a combination of structural and land fill techniques. The first phase would provide a 400,000 TPY non-ferrous ore loading facility and the second phase is to provide an additional 5,000,000 TPY iron ore loading facility. Northerly winter winds and southerly summer winds dictate a north-south orientation of the loading berth. These winds would not be seriously detrimental to the operation as contemplated. Docking difficulties experienced by Alaska State Ferries are largely caused by the cross wind orientation of the existing ferry terminal. Cold temperatures may hamper the efficiency of loading but technological solutions should be possible for the avoidance of downtime of equipment. The available soils information indicates that the combination structure and land fill would be quite feasible. Current, floating ice, silting or waves are nominal and should not cause significant operational problems. The estimated maximum costs for a proposed facility at Skagway are as follows:

	Facility Capacity		
	400,000 TPY (a)	5,000,000 TPY (b)	Total 5,000,000 TPY
Capital Costs	$4,046,000	$7,765,000	$11,811,000
Approximate Operating Costs	$0.85/L.T.	$0.75/L.T.	$0.75/L.T.

(a) Anvil anticipated volume

(b) Possible iron ore development.

Dyea (or Daiya), N.W. of Skagway at Delta of Taiya River

General climatic and hydrographic data approximates that of Skagway Harbour. The tidal runout at Dyea, however, is far more extreme than at Skagway and the distance between the most reasonable deep water sites for a wharf and the most appropriate storage area is so great that it would require an exorbitantly expensive conveyor system. The alternatives are either to dredge the tidal flats or to extend the overland transportation to deep water with a large storage area being created from the steep hillside. Either of these alternatives would be extremely expensive, and it is considered that the problems described herein rule out Dyea as a potential site for the ore loading facility.

Haines (Lutak Inlet)

There are a number of satisfactory deep water sites available for development along the southern shore of Lutak Inlet. These sites are protected from winds by the moutains to the north and the south of the Inlet, with the exception of Willowa gusts. Current and waves are negligible. No shipping has been known to be significantly delayed by weather from berthing at the existing "Army" dock in this area. Soils are excellent for the construction of a pile-supported loading structure and a back-up land fill. The estimated maximum costs for a proposed facility at Haines are as follows:

	Facility Capacity		
	400,000 TPY (a)	5,000,000 TPY (b)	Total 5,000,000 TPY
Capital Costs	$3,688,000	$6,980,000	$10,668,000
Approximate Operating Costs	$0.90/L.T.	$0.80/L.T.	$0.80/L.T.

(a) Anvil anticipated volume

(b) Possible iron ore development.

Note that the principal capital cost savings at Haines as compared to Skagway result from reduced dredging and elimination of modifications to the existing waterfront facilities in the second phase.

Haines (Letnikof Cove)

While a deep water loading facility could be constructed at Letnikof Cove, the site is not considered as suitable as the sites at Lutak Inlet. The following problems were observed.

1. Gusts of wind up to 70 knots occur from either the northerly or southerly directions.
2. An access road connecting Letnikof Cove with the Haines cut-off road would be required.
3. The existing cannery on the Point would either have to be purchased, or an arrangement concluded involving continuing cannery operations at the present location with easements for the hauling road. If the cannery were purchased, this would add a capital cost of approximately $300,000.

It is considered that these problems make Letnikof Cove an inferior site to Lutak Inlet.

V. Analysis of Sites

Skagway Harbour

1. Site Conditions

(a) Property, Topographic and Geologic Conditions

i. The city of Skagway owns all tidelands in Skagway Bay except the land under the White Pass & Yukon Route wharf, one tract of about one-half acre north of the small boat harbour and east of the road to the ferry terminal, and one tract of about one-half acre west of the ferry terminal road and adjoining that road. It is believed that acquisition of the latter two tracts is possible if it were necessary for project development.

The principal existing Waterfront facilities are the ferry terminal and the small boatbasin. Preliminary studies indicate that neither of these need be moved to create phase 1 facilities (400,000 TPY), although the ferry dock may have to be relocated for phase 2. This would not conform to the Master Plan as prepared by the Alaska State Housing Authority in March 1964, but, as the entire waterfront is proposed for industrial zoning, and since the ferry terminal orientation presently makes docking difficult, it is not considered that this move would be opposed by the citizens of Skagway or the Ferry System.

Sufficient acreage can be reclaimed at the selected site between the ferry terminal and the rock jetty utilizing dredged material to

develop an adequate ore storage and rail yard facility to serve phases 1 and 2.

The first stage should be constructed toward the ferry dock as depicted in the Skagway Harbor layout (as illustrated in the diagram following this Appendix) in order to defer possible conflict of waterfront construction in the area of the breakwater with the flight zone of the airport. A study is currently underway with the object of relocating the airport to the 500 foot level of the Dewey Lake area. It is thought that the airport would be relocated by the time the second phase would commence.

The City is prohibited by Article III of the Tidelands Ordinance from selling any of the tidelands. Leases may be issued for periods of not less than five years nor more than fifty-five years. Appraisal must be conducted prior to leasing or renewal of leases, and annual rent shall be not less than six percent of appraised valuation of the land and any City-owned improvements. Annual rentals are subject to adjustment every five years by the City Council. Tidelands are currently appraised at 15 cents per square foot, or U.S. $6,534 per acre. This yields a tidelands lease of $392.04 per acre annually. All leases having a computed annual minimum rental of more than $100 must be offered at public auction.

ii. According to recent test borings which were conducted on the site the subsoil is a sandy gravel with very few cobbles larger than "fist" size and with negligible soft or compressible layers. The material appears ideal for pile-supported structures and for superimposed loads of fill. It would appear that the allowable soils pressure would be in excess of 6,000 lbs. per square foot. The experience in dredging the approximately 350,000 cubic yards from the small boat basin was extremely good with a maximum dredging velocity using a 24-inch diameter line of 1,200 tons per hour. According to verbal reports from professionals involved in that project, the nature of the soil as reported would confirm this fact of good dredgibility. It is estimated that the sand and gravel layer may be as deep as 600 feet, and that it overlies quartz diorite, a coarse, massive igneous rock common to the Coast Range batholith.

iii. The recent seismic history of the southeastern Alaska area is not as severe as in the Cook Inlet area. In all Pacific rim areas, however, there exists the danger of major earthquakes and it is recommended that a lateral design factor of not less than ten percent of the mass be utilized for any pile-supported structure. Earthquakes as severe as any ever recorded occurred in 1899, 150 miles north of Skagway. We would also recommend that half of the live loads be included in the determination of mass. If hanging ice occurs (although not reported), it must be considered in mass computations.

(b) Climatic Conditions

i. According to the United States Coast Pilot 8, 1962 Edition, and local information, during the winter northerly winds ranging in velocity up to 35 knots blow down the Skagway River gorge. The orientation of these winds varied from northerly to northeasterly. Gusts up to 70 knots occur. During the summer, southerly winds up to 30 knots blow up the Lynn Canal. The easterly portion of the Skagway River delta is somewhat sheltered from the southerly winds by east walls of the fjord-like Lynn Canal which leads to Skagway from the south. Summer gusts up to 65 knots occur.

ii. According to the U.S. Corps of Engineers' design data for military construction, the maximum yearly snowfall at Skagway warrants a snow load of 35 lbs. per square foot.

iii. As mentioned above, there is no information as to the icing of piling in Skagway due to tidal fluctuation in sub-freezing temperatures. This factor should be investigated and the appropriate precautions taken.

iv. The maximum temperature range is from a record low of -24°F. to a record high of +92°F. The average monthly temperature is 41°F.

v. Fog at Skagway is exceedingly rare and is said to occur no more than five days a year in which fog limits the visibility to between ¼ and ½ mile.

vi. The average frost-free season is 180 days long, from early May to mid-October.

(c) Hydrographic Conditions

i. Tide: The extreme low water is approximately -5.0 feet and extreme high water is approximately +21.0 feet with M.L.L.W. taken as 0. The maximum tidal range is in the proximity of 26 feet.

ii. A maximum current of up to 1.5 knots occurs near Skagway due to tidal action, but would not hamper shipping in any way.

iii. Floating Ice: Significant icebergs are not encountered in the Lynn Canal.

iv. Minor silting is expected in the area to the east of the existing breakwater at Skagway Harbor, and somewhat more silting can be expected to the west of the existing breakwater. It is our opinion that little or no maintenance dredging would be required in the area of the selected facility, although some maintenance dredging

would be necessary for a facility, such as a ferry terminal and general cargo dock, which might be built to the west of the existing breakwater. It is anticipated that the cost of any maintenance dredging would be within acceptable limits.

v. Absolute maximum offshore wave height at the northern end of the Lynn Canal near Skagway Harbor approximates seven feet. These seas would not hamper vessels of the size being contemplated.

(d) Necessity for Auxiliary Work not Related Directly to the Bulk Handling Facility:

i. The initial earthwork which would be required for phase 1 of the project would consist of dredging a berthing basin to approximately -40 feet, the dredged material being used as fill on the land side.

ii. The existing railroad trackage would require extension to the new facility and a system to dump the ore containers would be required. Assuming that the zinc-lead concentrate requires covered storage, a storage shed or dome would be required.

iii. A limited extension of the existing railroad trackage would be required to bring the concentrate containers to the proximity of the above storage dome. Auxiliary gravel yard paving and miscellaneous site work would also be required.

iv. It is anticipated that approximately 900 linear feet of breakwater work would be necessary. Armor rock to protect the land fill area will be required in the tidal range.

2. Harbor and Shipping Data

i. Sufficient turn-around basin is available for the operation of 40,000 to 500,000 ton ore vessels under most wind conditions, given the condition of nominal current and waves. Under high wind conditions it is probable that turnaround will not be possible for a 100,000 ton or larger vessel without tug assistance. A hydraulic hull analysis should be performed to determine the effects of maximum winds on the turnaround characteristics of 100,000 ton to 500,000 ton vessels. Preliminary analysis does not indicate that a significant increase of port time would occur because of turning problems.

ii. The proposed facility would fall within established harbour boundaries and thus it is not anticipated that the U.S. Army Corps of Engineers would object to it. The site is outside the boundaries of the Tongass National Forest and so would not be affected by Forest Service regulations. While some sport fishing waters exist

in the general Skagway area, there are no significant commercial fishing operations therein. The Skagway River is not a migratory salmon stream.

iii. The required draft for ocean-going vessels in the 40,000 ton class can easily be achieved, and drafts of 50 or 60 feet to accommodate the largest anticipated vessels for future iron ore movements can also be achieved by dredging. Very deep water exists a short distance to the south of the Skagway Harbor. Nothing indicates that vessels up to 500,000 DWT would be unable to be accommodated at Skagway. Facilities for 500,000 DWT vessels would require 80 feet of water alongside the pier at low tide, and berth lengths for travelling loader operation would be approximately 250 feet longer than for 100,000 DWT vessels. These criteria can be met at Skagway, although construction would surely go to caissons as the bottom falls off rapidly to the south.

Japanese sources indicate that tankers in the 300,000 DWT class are now under construction with 500,000 DWT tankers expected in the near future. The economics of loading and unloading large vessels carrying dry cargo such as ore are affected by the fluctuations in use of shore facilities. Theoretically, one very large vessel making 12 trips a year could carry the entire possible production of 5,000,000 TPY. However, this would result in very high unit costs at the shipping point and at the receiving point. Thus it is probable that five or six 100,000 DWT ore carriers would be more economical despite higher ship unit operating costs. A definitive statement in this regard is outside the scope of this report. Sumitomo Mining Metals states that phase I shipping requirements would require a fleet of 30,000 DWT vessels and would in no case exceed 60,000 DWT. Trans Pacific ocean freight for nonferrous concentrates approximates $8.50/Long Ton utilizing 12,000 ton DWT vessels. The current tariffs for Trans Pacific iron ores approximate $3.50 to $4.50 per long ton range utilizing 30,000 ton DWT vessels according to Sumitomo.

iv. Future first phase shipping of approximately 400,000 tons per year could easily be accommodated at Skagway in terms of stockpile size as could the ultimate volume which is considered in this report, i.e., 5,000,000 tons per year. The potentially available level land adjacent to the Skagway Harbor is approximately 80 acres. This land should be ample for the railyard, storage and loading facilities. Maximum stockpile size assuming 100,000 ton vessels would be about 200,000 tons.

3. Costs

i. It is estimated that the capital cost of developing the loading facility at Skagway for 400,000 TPY capacity is $4,046,000.

The additional capital cost to increase the capacity to 5,000,000 TPY is estimated at $7,765,000, or a total cost at 1967 prices of $11,811,000.

The capital cost estimates, shown in detail in Appendix A, show that the costs at Skagway are higher than at Haines. This is caused primarily by the more extensive dredging and landfill requirements at Skagway. Ship-pulling equipment would also be more costly at Skagway because of higher winds. In addition, the 400,000 TPY facility at Haines is designed for a trucking operation which also tends to lower capital costs.

ii. It is estimated that the annual operating costs of the facility at Skagway would be slightly lower than the costs at Haines. Operating costs of 85 cents per long ton for the 400,000 TPY and 75 cents for the 5,000,000 TPY are estimated. Costs at Haines would be some five cents per ton higher.

Dyea – at Mouth of Taiya River

1. Site Conditions

(a) Topographic and Geologic Conditions

i. On account of the extensive tidal runout, the bulk handling pier should be located to the south end of the Taiya Inlet on the east shore. This shore of the Inlet is extremely hilly and the peninsula is quite narrow. Considerable earth moving would be required to create level land at this site. Overland transportation from the present terminus of the White Pass & Yukon Railway would require a relatively long run along the shores of the Taiya Inlet to the selected port site.

ii. Soils information is not directly available at Dyea, but visual observation indicates that the sand and gravel in the Taiya River Delta extends to a substantial depth below the existing mud flats. Timber, concrete or steel piling would be acceptable and the proximity to the surface of bedrock would dictate the use of steel-shod piles. It is anticipated that soil pressures should not exceed 3,000 or 4,000 lbs. per square foot for design.

iii. Seismic conditions are identical to those at Skagway and Haines.

(b) Climatic Conditions

Wind, snow, ice, temperature and fog approximate the Skagway conditions. However, the Dyea site is exposed to southerly winds to a greater extent than the Skagway site.

(c) Hydrographic Conditions

Tide, current, floating ice and wave conditions approximate those at Skagway.

Silting would present a problem, with a tidal runout in excess of one mile .The Taiya River carries substantially more silt than the Skagway River and, if a port were established here, maintenance dredging problems could be severe.

(d) Necessity for Auxiliary Work not Related to the Bulk Handling Pier

i. A large amount of the earthwork would be required in order to create the level ground as well as to excavate and dredge for the port site itself.

ii. Extensive roadway or railroad construction including possible tunneling would be required to reach the pier area from the Skagway terminus of the railroad or from other proposed rail locations.

iii. Breakwater work is not anticipated, although it is possible that a silt-confining breakwater might be required.

iv. While probably not difficult to create, a 40 foot or 60 foot draft would require extensive dredging. It would be increasingly expensive the nearer to the head of the Inlet the pier were placed.

2. **Harbour and Shipping Data**

i. The turn-around basin available in the Dyea side of the Taiya Inlet is not sufficient for 100,000 ton vessels under adverse weather conditions and without assistance from a tug. Under favourable weather conditions, the ore ship could back out to the wider portion of the Inlet, one-half mile to the south of the Dyea site and then turn.

ii. The only restrictions imposed by others would conceivably be fish and game restrictions due to nesting water fowl. The port site, however, is to the south of the tidal flats and therefore it is not anticipated that this would be a serious problem.

iii. As mentioned above, it would be costly to achieve the required draft at this site.

iv. The expansion from 400,000 tons per year capacity to 5,000,000 TPY capacity would be costly, although it is possible to accomplish.

v. There is no shipping at this site except for a log export traffic of short duration. However, it should be noted that during the Klondike gold rush, Dyea rivaled Skagway as a port.

3. **Costs**

i. The anticipated capital costs of a facility for 400,000 TPY would be in excess of $5,000,000. The cost to develop Dyea Harbour exceeds the cost of developing a port facility at Skagway because

of excessive dredging, power, water and auxiliary structures, and the lack of suitable flat land near deep water.

ii. Estimated operating costs of a facility at Dyea would be greater than at Skagway, because of the additional costs of maintenance, dredging, overland transportation and higher rates for water and power. It is estimated that operating costs at Dyea would exceed those at Skagway by some eight cents per long ton.

Haines – Lutak Inlet

1. Site Conditions

(a) Topographic and Geologic Conditions

i. Level land is available or can easily be created adjacent to feasible port sites in the Lutak Inlet. An existing state highway beside the selected port site is below a useable standard. However, the State Highway Department has developed an alignment and is contemplating upgrading this highway. The highway links the possible port site to the town of Haines, seven and a half miles away.

ii. Soil consists of sand, gravel and decomposed granite and is considered to be excellent material for fill. Allowable soil pressures would be in the range of 5,000 PSF. Bedrock in this region is in the Coast Range batholith. Steel piles would be in the most satisfactory load-bearing elements due to contemplated drafts and soils not conducive to jetting.

iii. Seismic conditions approximate those at Skagway.

(b) Climatic Conditions

i. Winds are not a significant problem at the Lutak Inlet sites with the exception of Willowa gusts which draw over mountain gaps on occasion. It is reported that ship berthing is very rarely affected by these winds, and that a very short lay-up period is usually sufficient to ride them out and allow berthing. The snow loads, according to U.S. Army Corps of Engineers' design standards, should be taken at 55 lbs. per square foot.

ii. The formation of ice on pilings is not a common problem at Haines.

iii. The maximum temperature range is from a record low of – 16°F. to a record high of + 90°F. The average monthly temperature is 41°.

iv. Fog at Haines is not common and should not be considered a significant problem.

(c) Hydrographic Conditions

i. The extreme tidal range is similar to that at Skagway, and approximates 26 feet.

ii. The current is negligible in the Lutak Inlet.

iii. Floating ice is not a problem in the Lutak Inlet.

iv. Silting is not a problem in the Lutak Inlet.

v. Waves of a significant height do not occur. The maximum wave height at the recommended site would not exceed three feet and would not restrict berthing for anticipated ore vessels.

(d) Necessity for Auxiliary Work not Related to the Bulk Handling

i. Some earthwork would be required to create the necessary level area at the recommended site. This work would not require blasting, and could be done by bulldozers and rippers. The cost of such earthwork would be relatively inexpensive. Additional filling would be required to create sufficient area for the 5,000,000 TPY capacity port as is reflected in the cost estimates.

ii. The roadway from the existing transportation route, the Haines cut-off, to this site would require upgrading. This is presently contemplated by the State Highway Division. Private capital may be required to relocate the present Lutak road.

iii. No breakwater would be required.

iv. Dredging requirements would not be as extensive as at Skagway, but the harbour bottom composition is somewhat rockier.

Unless cobbles are encountered, dredging is not considered a significant problem. It is known, however, that dredging at the small boat basin was made very costly by a rocky condition, and the capital cost estimates reflect higher costs for a portion of the dredging.

2. Harbour and Shipping Data

i. There is an adequate turning basin for the vessels required for either the 400,000 ton per year volume or the 5,000,000 ton per year volume. There presently exists a 1,060 foot filled cellular sheet pile structure built in 1942/43 by the U.S. Army as a marginal wharf facility which has a reported 40 feet of draft along its face. The majority of this facility is used for log export activities on a job lease basis, with the remainder of the wharf being used for Alaska State Ferry berthing. The area to the north of this facility and to the south of the new Schnabel timber processing and export plant is reportedly owned by a Mr. Schaffer of Sitka, Alaska, and would be a very acceptable site for the shipping as contemplated in this report. The site to the north of the Schnabel plant is owned by the University of Alaska and managed by the Department of Lands, State of Alaska, and is probably more readily available as a port site than the private land between the Schnabel facility and the existing Army wharf. Vessels up to 500,000 DWT could be readily accommodated in the Inlet.

ii. The Federal Government restricts access to the area of the oil tank farm and POL (Petroleum, Oils and Lubricants) facility south of the U.S. Army wharf. The selected site would not be affected by these restrictions. Corps of Engineers, Fish and Wildlife Service, and possibly Coast Guard approvals would be required for a facility in the Lutak Inlet. Since the State Government owns the favourite site, certain procedures must be followed in obtaining this land for port use. The State must be requested to auction the land for the specific use defined by the requestor.

Local government pollution or zoning restrictions are non-existent.

iii. Drafts up to 80 feet should be readily available with nominal dredging because the water is very deep close to shore.

iv. Future harbour expansion would not be difficult at this site. If a railroad facility should be extended to the site, it could easily be adapted to handle unit trains, although land filling would be necessary to achieve sufficient storage and rail handling area.

v. There is no shipping of ore at present through this port and current shipping consists mostly of the export of lumber and the import of oil products at the Army POL facility. A specialized lumber carrier, the "Haines Maru", has commenced monthly calls, using the Army dock. It is anticipated that 60 MBF will be shipped to Japan in 1968.

3. Costs

i. The capital cost estimates of the facility for 400,000 tons per year capacity is $3,688,000.

A 5,000,000 TPY facility would cost an estimated $6,980,000 more than the cost for phase 1 capacity total of $3,688,000, or $10,668,000. This is less than the anticipated total at Skagway principally on account of less dredging costs and elimination of the cost of modifying existing facilities such as the ferry dock at Skagway.

ii. It is estimated that operating costs of a port facility at Haines would slightly exceed costs at Skagway. One reason for this is the somewhat higher cost of loading ore from trucks rather than rail cars for the 400,000 TPY phase. For the 5,000,000 TPY phase a rail system is considered to be in use. Operating costs for the 400,000 TPY phase are estimated at 90 cents per long ton, and for the 5,000,000 TPY phase at 80 cents per long ton.

Haines – Letnikof Cove

1. Site Conditions

(a) Topographic and Geologic Conditions

i. A large amount of level land is available for an ore storage area in the saddle to the south of Letnikof Cove. At present a salmon

cannery (Haines Packing Co.) is located on the west shore of the Cove. Letnikof Cove is served by a State gravel road which is not up to suitable standards and would have to be improved as well as extended across the Deshu Isthmus to by-pass Haines and link with the Haines Junction road.

ii. Soils conditions are generally good for the construction of a pier and/or land fill. Previous pile-driving history indicates that a penetration of 10 to 12 feet is easily achieved utilizing a 1,200 lb. drop hammer dropping approximately five to six feet. Pile penetration refusal has not been achieved, according to local residents. There are no apparent foundation problems for shore facilities.

iii. Seismic conditions approximate those at Skagway or Lutak Inlet.

(b) Climatic Conditions

During the winter northerly winds ranging to 40 knots in velocity with gusts up to 75 knots blow down the Chilkat River. In the summer southerly winds ranging in velocity up to 30 knots blow up the Lynn Canal and across the Chilkat Peninsula with occasional gusts up to 65 knots. Snow conditions approximate those at Lutak as do temperatures and fog. Occasional ice is encountered in the Letnikof Cove area in the form of small floating icebergs. Occasional pancake ice is noted at the Cove but would not in any way hamper shipping.

(c) Hydrographic Conditions

i. Maximum tidal range is approximately 26 feet.

ii. Virtually no current is experienced in Letnikof Inlet.

iii. Some minor silting can be expected to the north of Letnikof Inlet from the Chilkat River. The 20-year history of this silting indicates that only minor silting has taken place south of Pyramid Island. Consequently it appears that the silting-up of Letnikof Cove is highly unlikely.

iv. Waves should not exceed three feet in the Letnikof Cove area and would not hamper shipping.

(d) Necessity for Auxiliary Work not Directly Related to the Bulk Handling Facility

An acceptable site for the ore loading facility would be at a point along the west bank of the Cove north of the cannery. A considerable amount of excavation and embankment work would be required in the immediate area of the pier; furthermore, a roadway and a conveyor would have to be constructed to connect the storage facilities south of the cannery with the berth. No breakwater would be required, but a fairly considerable amount of dredging would be needed. The estimated volume of dredging would be in the neighbourhood of 150,000 to 200,000 cubic yards. Another more feasible approach would be to create level land for storage

north of the cannery and construct a haul road behind the cannery. Neither site is considered as suitable as the Lutak Inlet site from the standpoint of deep draft vessels or overall cost.

2. Harbour and Shipping Data

i. Sufficient turn-around basin beyond the mouth of Letnikof Cove would be available for the largest ships being considered.

ii. No restrictions are anticipated by Federal or State agencies for the construction of a wharf or loading facility.

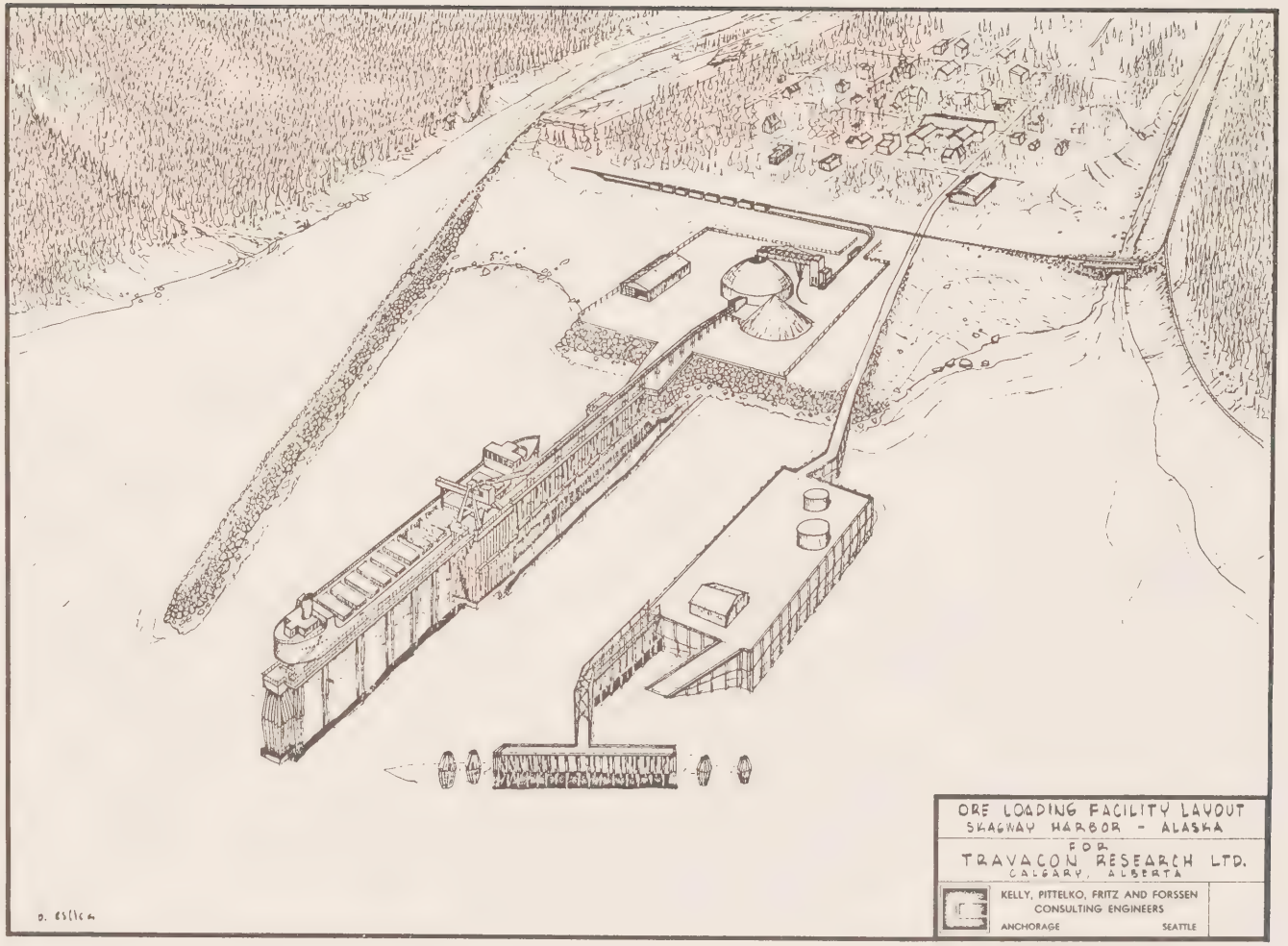
iii. The present draft adjacent to the cannery pier is approximately 16 feet at low water. By extending another pier farther out into the cove, and dredging, a 40-foot-draft at low tide could be achieved. It would be very costly to handle 5,000,000 TPY at this site and the alternatives are to reclaim about 50 acres for storage and rail-yard use, or to have a long conveyor onto the peninsula.

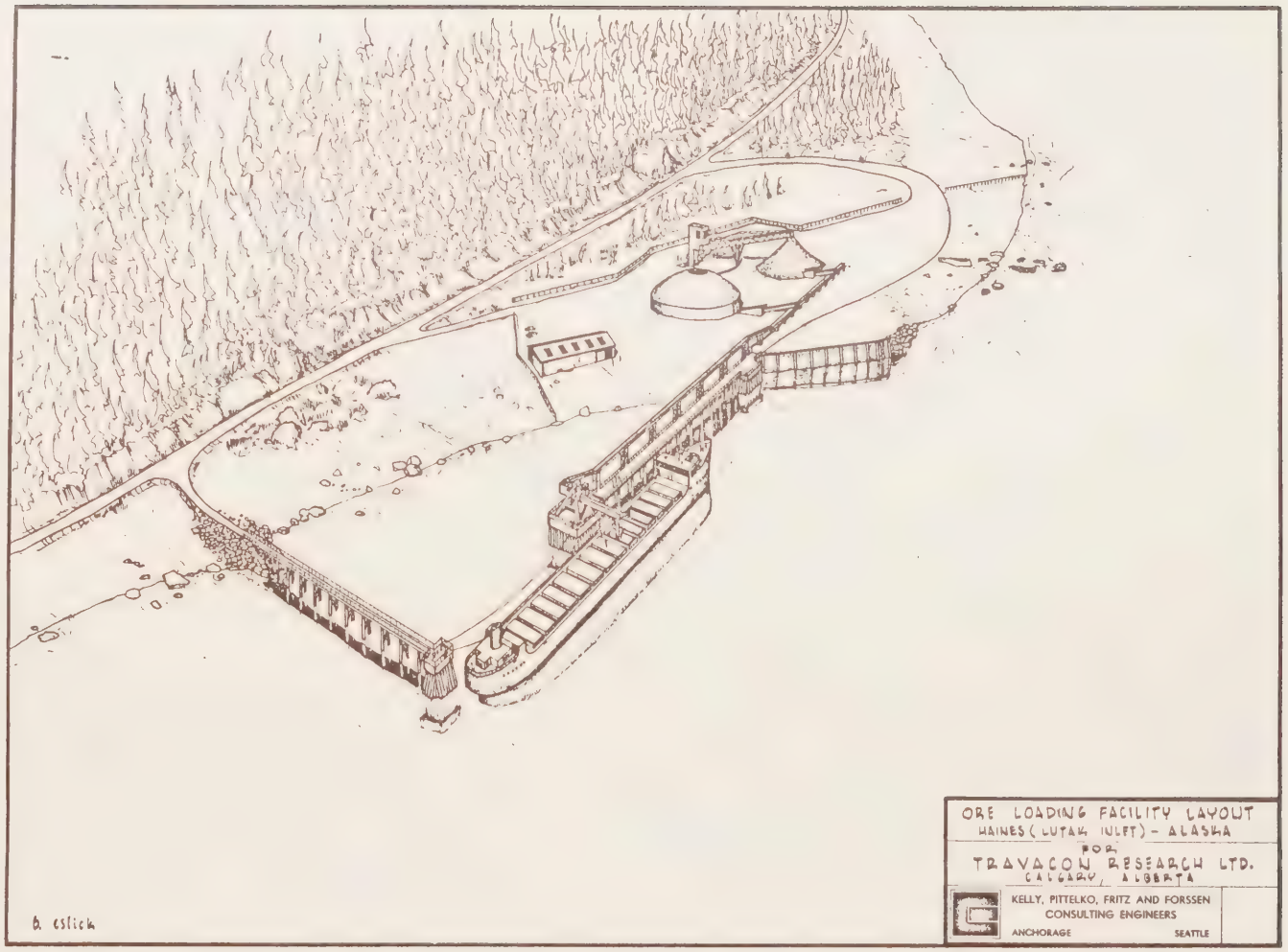
iv. Present shipping consists of fisheries products. A small Alaska Steamship Company coastal freighter calls at the cannery dock for general cargo unloading and fish product loading. The maximum size vessel presently serving this port is in the 4,000 ton class.

3. Costs

i. The estimated capital cost for a 400,000 TPY facility at this site is $4,200,000.

ii. Estimated operating costs at Letnikof Cove can be expected to exceed the operating costs at Lutak by approximately five cents per L.T. due to the additional cost of maintenance dredging and the higher rates for water and power.


ORE LOADING FACILITY LAYOUT
SKAGWAY HARBOR - ALASKA
FOR
TRAVACON RESEARCH LTD.
CALGARY, ALBERTA
KELLY, PITTELKO, FRITZ AND FORSSEN
CONSULTING ENGINEERS
ANCHORAGE
SEATTLE


ORE LOADING FACILITY LAYOUT
HAINES (LUTAK INLET) - ALASKA
FOR
TRAVACON RESEARCH LTD.
CALGARY, ALBERTA
KELLY, PITTELKO, FRITZ AND FORSSEN
CONSULTING ENGINEERS
ANCHORAGE
SEATTLE
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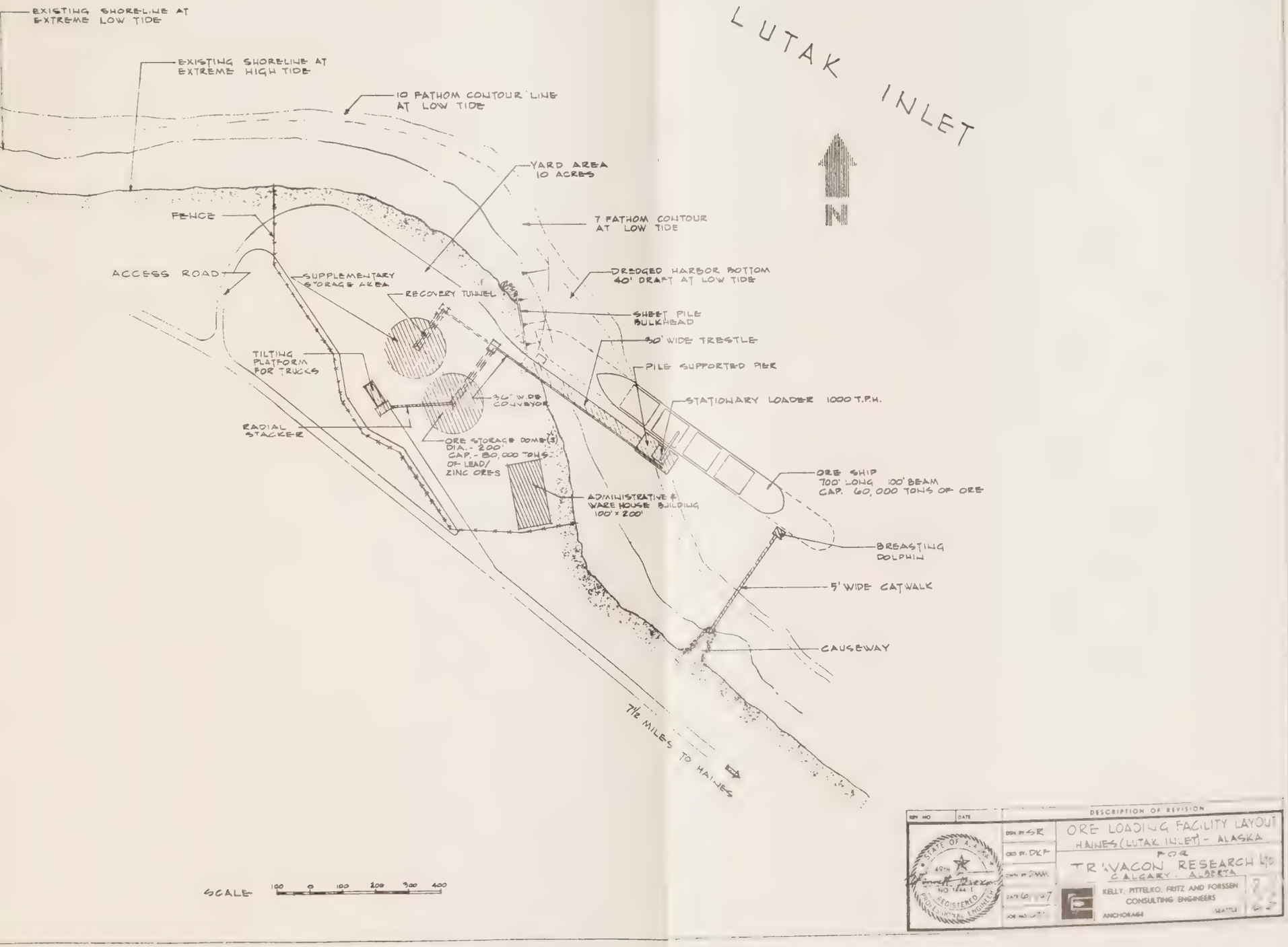
SKAGWAY RIVER
CITY OF SKAGWAY
EXISTING SHORE LINE AT EXTREME HIGH TIDE
YARD AREA 69 ACRES 900' x 550'
MAIN
STATE
4TH
BROADWAY
SPRING
200'
300'
NEW TRACKAGE
RECOVERY TUNNEL
ORE STORAGE DOME(S) DIAMETER 200' CAPACITY 80,000 TONS OF LEAD/ZINC ORES
ADMINISTRATIVE & WAREHOUSE BUILDING 100' x 200'
RAILROAD CAR SHAKER
EXISTING R.R. SPUR
RADIAL STACKER
SUPPLEMENTARY STORAGE AREA
LANDFILL
EXISTING BREAKWATER
EXISTING ARMY BARGE TERMINAL (NOT IN USE)
RIP-RAP
EXISTING CAUSEWAY
EXISTING W.P.Y.R. R.R. TRACKAGE
30' WIDE TRESTLE
36" CONVEYOR
EXISTING SHORE LINE AT EXTREME LOW TIDE
DREDGED SLIP 200' WIDE 40' DEPTH AT LOW TIDE
STATIONARY LOADER 1000 TPH
PILE SUPPORTED PIER
5' WIDE CATWALK
EXISTING FERRY TERMINAL
7 FATHOM CONTOUR AT LOW TIDE
ORE SHIP 700' LONG 100' BEAM MAX. CAPACITY 60,000 TONS
10 FATHOM CONTOUR AT LOW TIDE
SMALL BOAT HARBOR
FERRY DOCK
SMALL BOAT HARBOR BREAKWATER
SCALE 100' 0 100' 200' 300' 400'
REV NO. DATE
DESCRIPTION OF REVISION
DSN BY SR
CKD BY DKP
DWN BY DMM
DATE 6/11/67
JOB NO. 6771
ORE LOADING FACILITY LAYOUT
SKAGWAY HARBOR - ALASKA
FOR
TRAVACON RESEARCH LTD.
CALGARY, ALBERTA
KELLY, PITTELKO, FRITZ AND FORSSEN
CONSULTING ENGINEERS
ANCHORAGE SEATTLE
SHT NO
STATE OF ALASKA
49TH
REGISTERED
PROFESSIONAL ENGINEER
NO 1444-E



REV NO	DATE	DESCRIPTION OF REVISION
		DSN BY SR
		CKD BY DKF
		DWN BY DMM
		DATE 6-67
		JOB NO

STATE OF ALASKA 49TH NO 1744 REGISTERED PROFESSIONAL ENGINEER

ORE LOADING FACILITY LAYOUT
HAINES (LUTAK INLET) - ALASKA
FOR
TRAVACON RESEARCH LTD
CALGARY, ALBERTA

KELLY, PITTELKO, FRITZ AND FORSSEN
CONSULTING ENGINEERS
ANCHORAGE SEATTLE

Skagway Harbour Looking Southwest

Skagway Harbor Looking North from Jetty

Skagway Harbor Looking South Down the Taiya Inlet

SKAGWAY HARBOR

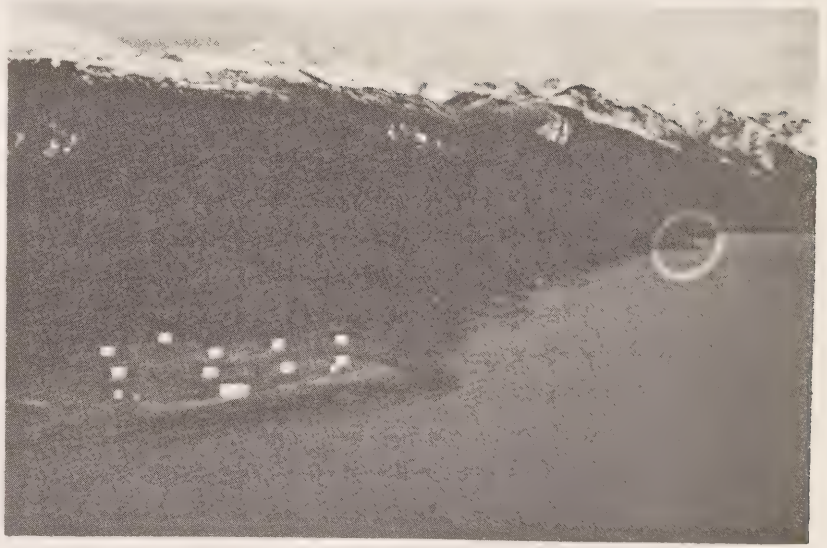
Looking West in Taiya Inlet – Dyea to Right (North)

Area of Facility – South End of Inlet

Roadway – East Shore of Taiya Inlet
Looking North to Dyea

Looking South from Site Toward Haines

Looking North Toward Lutak Site



Aerial View of Lutak Inlet – Site Circled

HAINES – LUTAK INLET

Letnikof Cove Site – Looking West

Head of Letnikof Cove from Beach

Letnikof Cove from the Air

APPENDIX C
SKAGWAY – CARCROSS ROAD STUDY
WITH PHOTOGRAPHIC SUPPLEMENT
PREPARED BY THE
DEPARTMENT OF PUBLIC WORKS, OTTAWA

SECTION I

INTRODUCTION

At the request of Mr. E. A. Côté, Deputy Minister of the Department of Indian Affairs and Northern Development, a reconnaissance survey and engineering study was made in the summer of 1966 by the Department of Public Works on the feasibility of constructing a road from Carcross to Skagway and upgrading or relocating the existing road from Carcross to the Alaska Highway. The standard for this proposed road would be the Northern Administration Branch's Trunk Highway design with a twenty-four foot roadway and four foot shoulders. This is similar to the Canadian Good Roads R.C.U. 60 design standard.

The reconnaissance was carried out by helicopter in July, and although no detailed ground surveys were undertaken, frequent landings were made to check soil conditions, glacier and slide action, and the feasibility of construction through the more difficult sections. Extensive reference was made to the existing 1:50,000 map sheets and aerial photographs to obtain further information on soils and grades. Proposed locations were plotted on enlargements of the topographic maps and from these profiles were produced to assist in computing quantities.

From this study it is apparent that a road running from Skagway to the Alaska Highway, which would have to cross the Boundary Range of the Coast Mountains and other difficult terrain, although feasible, would be a difficult and costly undertaking.

The town of Skagway is situated on Taiya Inlet at the head of the Lynn Canal, which is the nearest deep water and ice free shipping point to Whitehorse and other places in the Yukon Territories. A narrow gauge railway runs between Skagway and Whitehorse, a distance of 110 miles, and there is a fairly good all-weather gravel road from Mile 904.5 on the Alaska Highway (approximately 15 miles south-east of Whitehorse) to Carcross, a distance of 35 miles towards Skagway. Too, the state of Alaska has constructed a 3 mile section of road, to a relatively low standard from Skagway north towards Carcross along the right or west side of the Skagway River. There has been considerable interest in both Alaska and the Yukon for completing a highway link from the Skagway to the Alaska Highway.

SECTION 2

SUMMARY

2.1 ROUTES INVESTIGATED

The routes investigated start at the Alaska Highway and cross over the Yukon Plateau to Carcross, Mile 0-35; proceed through the transitional zone between the Yukon Plateau and the Coastal Mountain, Mile 35-80; and then cross the summit of the Boundary Range of the Coastal Mountains before continuing down the valley of the Skagway River to the Pacific Coast, Mile 80-109.

The Yukon Plateau section traversed is a wide sediment filled valley. In the transitional zone the route follows along narrow lakes and through wide U shaped valleys at elevations of 2,000 to 3,000 feet. These valleys are walled in by mountains that rise abruptly to 7,000 feet or more. In the mountain section many of the mountain blocks have trapped small ice fields and glaciers in cirques and depressions between the jagged peaks.

The soils in these areas are generally:

Mile 0-35 – Sand, silt and gravels. Road building material is plentiful.

Mile 35-80 – (Warm Pass Route). This section consists predominately of solid rock and talus slopes but some fairly good road building material should be found in benches along the lakes and in the fans of some of the streams.

Mile 80-109 – (Warm Pass Route). This area is very rocky, but some granular material can be obtained from glacial morraines and creek fans.

Mile 68-102 – The Tutshi Valley route leaves the Warm Pass route at Mile 68 to rejoin it at Mile 102. From Mile 68 to 77 there is an abundance of sand and gravel eskers. The remainder consists of hummocky bare rock sidehill construction.

The route contemplated when the study was undertaken leaves the Alaska Highway at Mile 904.5, some 15 miles south-east of Whitehorse, Yukon Territories. From this point 35 miles of gravel surfaced road has been constructed in a southerly direction to the community of Carcross, which is situated on the narrows between Nares Lake and Lake Bennett. This road can be upgraded and used as part of the route, so that new construction could start at Carcross, unless a decision is made to use the alternate location which was investigated for this section of road. The route first investigated southerly from the narrows between Nares and Bennett Lakes, was the one that was studied and reported on by Mr. A. A. Wright of our Whitehorse Office, on December 2, 1963. After bridging the

narrows between Nares and Bennett Lakes, at Mile 35, the route would follow the shore of the Nares and Tagish Lakes to Windy Arm. The west shore of Windy Arm is then followed to a low pass that gives access to Tutshi Lake at Mile 54. The west side of Tutshi Lake is followed to its south end where the Tutshi River flows into it. The route then climbs out of this valley to a relatively high, lake dotted, plateau, which is crossed in a southerly direction to Teepee Creek – Mile 75 – and along Warm Creek. A tributary of Warm Creek is climbed to the highest point on the route (3900 feet) throught what is known as Warm Pass. The route then drops abruptly into the valley of the Skagway River, crossing the International Boundary fairly soon after starting the descent. This valley is followed to the City of Skagway, Alaska. This route presents many difficulties in both construction and maintenance due to rock slides, and as it is in a very heavy snowfall area, there is the problem of snow removal and snowslides.

2.2 ALTERNATE ROUTES:

It was quite evident from the start that no easy route could be found to the coast, but there were alternatives which merited study and consideration.

"A" BENNETT LAKE ROUTE –

An examination of the route along Bennett Lake and through White Pass, which is followed by the Whitepass and Yukon Railroad, was examined but discarded because:

(i) Steep rock cliffs rise from Bennett Lake in several locations and, since the railway is hugging the shore, construction of a highway in the same vicinity would be very costly and

(ii) the White Pass is very steep and narrow, and the railway has wound its way through by shelving into the rock cliffs and trestling over the gorges. The only place a highway could be built through White Pass would be on the opposite side of this deep gorge.

Because of the precipitous sidehill and excessive curvature required to construct a road on the opposite side of White Pass and the costly construction along Bennett Lake, this location as an alternative was ruled out.

'B' PADDY'S PASS –

Another alternative was to leave the original route at a point part way along Tutshi Lake at Mile 60, and then turn west through Paddy's Pass. The ascent from Tutshi Lake through the pass, however, proved to be excessively steep for highway construction as it would require gradients in excess of 10%.

'C' TUTSHI VALLEY –

The remaining alternative was a location up the Tutshi Valley, from Mile 68 where a relatively easy gradient can be obtained. However, there was still the descent to be made from the height of land, either through White Pass or some alternative. A defile approximately 1 mile west of White Pass appeared to have possibilities, and further investigation proved that a roadway could be built through this defile to the Skagway River Valley. The highest elevation reached in this pass was 3200 feet. As this location is also in a very heavy snowfall belt, which is almost treeless, the section of this route from Mile 68 to the top of White Pass at Mile 80 would be subject to strong winds and drifting snow.

2.3 CONCLUSIONS

From the investigation undertaken, there appear to be only two feasible alternative routes to link Skagway with Whitehorse. – (a) from the Alaska Highway via Carcross, by Tagish and Tutshi Lakes, through Warm Pass to Skagway or (b) an alternative beginning at Mile 68 and following the Tutshi Valley to rejoin the original route at Mile 102 in the Skagway Valley.

The route through the Tutshi Valley appears to be the better because:

(i) the overall length of the Tutshi Valley route from the Alaska Highway to Skagway is 96 miles long with 84 miles of it in Canada, whereas the Warm Pass route from the Alaska Highway to Skagway is 109 miles with 95 miles of it in Canada.

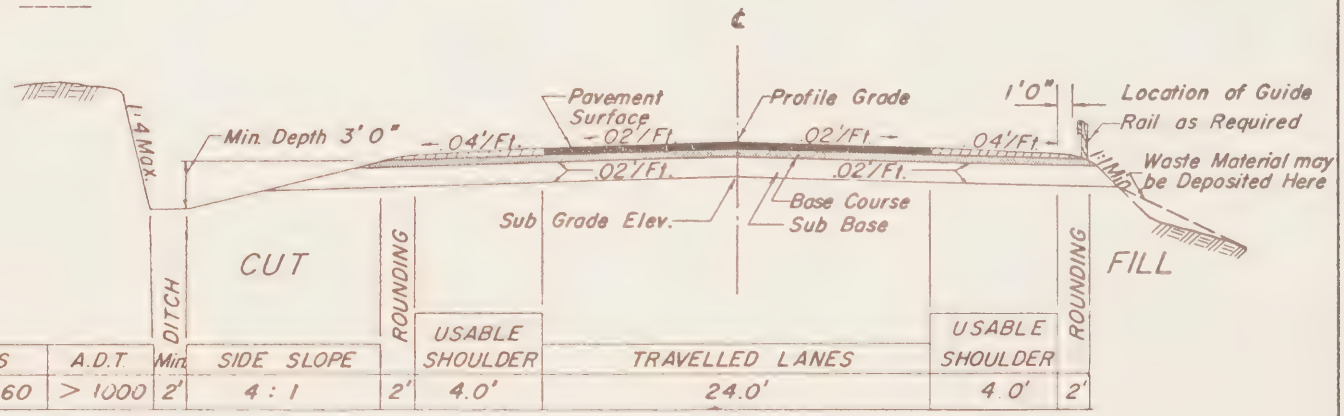
(ii) The estimated cost of the Tutshi Valley route for the portion in Canada is $19,529,000, whereas the estimated cost of the Warm Pass route is $24,066,000.

(iii) The top of the pass in the Tutshi Valley is approximately 700 feet lower than the summit on the Warm Pass route.

(iv) There would seem to be much less danger from rock and snow slides in the Tutshi Valley route, so maintenance costs should be lower.

It would be feasible but costly for the United States to construct a road from Skagway to connect with a road built to the Canadian-United States border in either valley. The United States' section of road required to meet the Tutshi Valley route in Canada would be two miles shorter than would be required for the Warm Pass route, but as the terrain is rougher, the cost of constructing along either location would probably be about the same. The United States' section to connect with the Warm Pass route would be subject to more rock and snowslides than the section required to connect with the Tutshi Valley route. No attempt has been made in this Appendix to estimate the cost of construction for the portion in the United States.

Wearing Course ———
Binder Course – – – –
Base Course Depth – – – –
Sub Base Depth ———



CLASS	A.D.T.	Min.	SIDE SLOPE		USABLE SHOULDER	TRAVELLED LANES	USABLE SHOULDER	
R.C.U. 60	> 1000	2'	4 : 1	2'	4.0'	24.0'	4.0'	2'

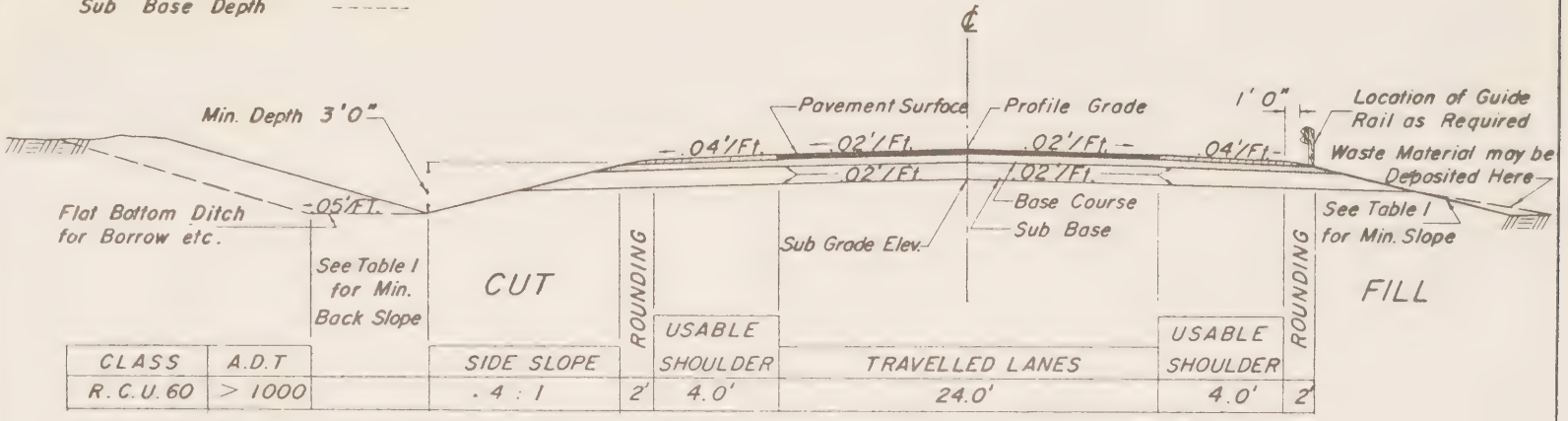
Note:
R.O.W. Minimum 80'
Preferred 100'

DEPARTMENT OF PUBLIC WORKS

DEVELOPMENT ENGINEERING BRANCH

ROCK SECTION
RURAL COLLECTOR UNDIVIDED (MODIFIED)
SKAGWAY HIGHWAY

DRAWN BY J. Lafontaine CHECKED BY B.N. and J.T.D.
APPROVED BY CHIEF ENGINEER R.T. Clarke
OCTOBER 1964



CLASS	A.D.T		SIDE SLOPE		USABLE SHOULDER	TRAVELLED LANES	USABLE SHOULDER		ROUNDING
R.C.U. 60	> 1000		.4 : 1	2'	4.0'	24.0'	4.0'	2'	

TABLE I

MINIMUM SLOPES

Height of Cut or Fill	TERRAIN Rolling	Mod Steep	Steep
0'—4'	3 : 1	2½ : 1	2 : 1
4'—10'	2½ : 1	2 : 1	1½ : 1
Over 10'	1½ : 1	1½ : 1	1½ : 1

Note:

A_ R.O.W. Minimum 80'
Preferred 100'

B_ Back Slopes Are Not To Be Flatter Than Side Slopes Except In Special Circumstances

DEPARTMENT OF PUBLIC WORKS

DEVELOPMENT ENGINEERING BRANCH

EARTH SECTION
RURAL COLLECTOR UNDIVIDED (MODIFIED)
SKAGWAY HIGHWAY

DRAWN BY J. Lafontaine CHECKED BY B.N. and J.T.D.

APPROVED BY CHIEF ENGINEER L.T. Clarke

OCTOBER 1964

SECTION 3

3.1 DESIGN STANDARDS

The estimates contained in this report have been developed on the basis of providing a highway meeting the following design standards:

(1) Maximum curvature 6°

It may be necessary to increase the degree of curvature slightly at two or three points for economic reasons. If the Warm Pass route is selected a switchback 12° curve will be necessary when descending to the Skagway Valley.

(2) Maximum gradient 6%

It will be necessary to increase the gradient to 8% or 9% for short distances through the mountainous terrain.

(3) Width of grade shoulder to shoulder 32 feet.

(4) High standard flexible pavement 24 feet in width.

The pavement consists of three inches of asphaltic concrete surfacing, four inches of Class 1 (3/4" crushed) base course, and varying amounts of select granular sub-base course to provide a road capable of supporting 18,000 lb. axle loads throughout the year.

3.2 VARIOUS SECTIONS OF THE ROUTES

The routes are described in more detail below, and in order to combine various sections of alternate routes in jurisdictional areas the project has been divided as follows:

A. Intersection with the Alaska Highway to Carcross via the existing road Mile 0 to Mile 35.

B. Intersection of the Alaska Highway to Carcross via a new location west of White Pass and Yukon Railway and the Watson River.

C. Carcross to the Yukon-British Columbia Boundary Mile 35 to Mile 50.

D. The Yukon-British Columbia Boundary to the Tutshi Valley approach Mile 50 to Mile 68.

E. The entrance to the Tutshi Valley to the International Boundary via the Warm Pass Mile 68 to Mile 95.

F. The entrance to the Tutshi Valley to the International Boundary via the Tutshi Valley Mile 68 to 84.

G. The International Boundary to Skagway via Warm Pass Mile 95 to Mile 109.

H. The International Boundary to Skagway via the Tutshi Valley Mile 84 to Mile 96.

3.3 GENERAL DESCRIPTION OF ROUTES

SECTION A – MILE 0 TO MILE 35

It has been noted previously that the existing Carcross Road meets the Alaska Highway at Mile 904.5. Since most of the traffic using the proposed Skagway Road would be between Whitehorse and Skagway, a shorter and more convenient connection could be made at Mile 909 of the Alaska Highway which is approximately 9 miles south of Whitehorse. This point then is designated as Mile 0 of the Whitehorse Skagway Road.

The route from Mile 0 to Mile 6 crosses a sediment filled valley where it joins the existing Whitehorse-Carcross Road. The existing road is then followed with some minor diversions, as shown on the accompanying plans. A general upgrading of the existing road would be required to meet the standards set out in Section 3.1.

SECTION B – MILE 0 TO MILE 35

This is an alternate route which might be constructed to replace Section A. Superior grades and alignment could be obtained on Section B, however the existing road could be upgraded at slightly less cost, and, if the diversion is constructed from Mile 0 to Mile 6 there would be no appreciable difference in the overall length of Section A or Section B. If it were necessary to maintain Section A after Section B was constructed, the extra cost of maintenance would indicate that Section A should be improved and adopted, otherwise a more detailed study would be recommended. Both routes lie in the Yukon Plateau and fairly good road building materials are available on either route.

SECTION C – MILE 35 TO MILE 50

A bridge approximately 600 feet in length will be required to cross the narrows between Lake Bennett and Nares Lake. These lakes are navigable waters and while small craft only have been using the channel in recent years, a minimum clearance above high water will be required from the Department of Transport. When the narrows have been crossed, this section of the route follows the south side of Nares Lake and Tagish Lake and the west side of Windy Arm, all of which lie in the Yukon Plateau and the transition zone to the mountains. The proposed route climbs from lake level 2152 feet to 2600 feet in the first 3 miles, in order to follow a bench. The shoreline is covered with a mantle of alluvium and glacial deposits containing large boulders and some graded gravel. At Mile 41 the route swings southerly along Windy Arm staying above a prominent rock bluff which rises steeply from the water and then descends to the lakeshore at Mile 47. The shoreline of Windy Arm is steep and rocky, with little soil cover, and the last 3 miles to the British Columbia boundary crosses an alluvial fan and then clings to the steep talus slope close to the water's edge.

SECTION D – MILE 50 TO MILE 68

This portion of the proposed route lying in British Columbia has been kept separate because the Warm Pass proposal and the Tutshi Valley proposal separate at Mile 68.

At Mile 51.5 the end of Windy Arm is reached. It is approximately 3 miles from the end of Windy Arm to Tutchi Lake, which are separated by a limestone ridge. This ridge may be crossed at elevation 2550 with a rapid descent to Tutshi Lake which is then followed to its southern end where the Tutshi River empties into it. The terrain along Tutshi Lake is similar to that along Windy Arm, with side-slopes varying from moderate to extremely steep, with exposed rock and a few fans and creek deltas. The route then starts to climb up the Tutshi Valley crossing the Tutshi River at Mile 65 and attaining an elevation of 3000 feet at Mile 68.

SECTION E – MILE 68 TO MILE 95

The Warm Pass route from this point on lies within the Boundary Range and most of it would have to be built in steep outcropped side slopes.

From Mile 68 to Mile 75 a rugged broad uplands plateau is crossed to the headwaters of Teepee Creek which is followed for another 5 miles to the Warm Creek Valley. The plateau is dotted with small lakes and swampy areas separated by granite outcrops with a scarcity of good road building material. The route enters the Warm Creek Valley by rounding a steep rock promentory at an elevation of approximately 2800 feet, and it is desirable to maintain or better this elevation by following close to the side slope of the valley for the next 5 miles in order to ease the ascent to the summit of the route. At Mile 84 an unnamed tributary of Warm Creek is followed to the summit of Mile 92, elevation 3900 feet. This valley is a steep narrow gorge with mountain peaks and glaciers on either side reaching elevations in excess of 6000 feet. To obtain reasonable gradients and minimize stream crossings and to avoid swampy areas on the valley floor, the route should follow the north side of the valley until nearing the summit of the pass. Although the north side of the valley is the better side for construction, a road built in this location would still be in danger from snow and rock slides which would add greatly to the cost of maintenance. Construction costs would be very high through this section. From Mile 92 to the International Boundary at Mile 95 a very steep descent is necessary into the Skagway Valley. Heavy rock work and a 12° switchback curve will be required to maintain grades of 8 or 9 percent, to descend to an elevation of 3100 feet which must be met by the section continuing onto Skagway.

SECTION F –

This route while it misses some of the spectacular mountain scenery of the Warm Pass route has many advantages. It is approximately 13 miles

shorter, reaches a maximum elevation of 3200 feet, avoids most of the dangerous slide areas, would be easier to maintain and is estimated to cost $4,500,000 less than the Warm Pass route. After entering the Tutshi Valley at Mile 68, the route crosses a wide lake and swamp studded plateau in a south westerly direction for approximately 7 miles to Mile 75. The material is generally sand with varying quantities of boulders and presents no great difficulty. The terrain then becomes more rugged and from Mile 77 to the International Border at Mile 83.6, elevation 3200 feet, the route winds between lakes over very rough rocky country with practically no overburden. This route crosses the Whitepass and Yukon Railway at Mile 78.4, which would be of considerable assistance during construction, if it were desirable to work other than from one end of the Canadian section of the project.

3.4 ESTIMATED COSTS

CANADIAN SECTION

A summary of the cost of the various sections is tabulated below:

SECTION A – MILE 0 TO MILE 35

Clearing and Grubbing	$ 161,000
Common Excavation	1,520,000
Rock Excavation	125,000
Culverts	140,000
Bridges	160,000
Sub-base Course	735,000
Base Course	306,000
Pavement	1,050,000
	$4,197,000
Plus 5% Contingencies	210,000
	$4,407,000
Plus 10% Engineering	441,000
	$4,848,000

SECTION B – ALTERNATE MILE 0 TO MILE 35

Clearing and Grubbing	$ 180,000
Common Excavation	1,600,000
Rock Excavation	130,000
Culverts	140,000
Bridge	560,000
Sub-base Course	735,000
Base Course	306,000
Pavement	$1,050,000
	$4,701,000
Plus 5% Contingencies	235,000
	$4,936,000
Plus 10% Engineering	494,000
	$5,430,000

SECTION C – MILE 35 TO MILE 50

Clearing and Grubbing	$ 104,000
Common Excavation	978,000
Rock Excavation	1,198,000
Culverts	60,000
Bridges	1,200,000
Sub-base	263,000
Base Course	150,000
Pavement	450,000
	$4,403,000
Plus 5% Contingencies	220,000
	$4,623,000
Plus 10% Engineering	462,000
	$5,085,000

SECTION D – MILE 50 TO MILE 68

Clearing and Grubbing	$ 92,000
Common Excavation	1,004,000
Rock Excavation	2,044,000
Culverts	72,000
Bridges	300,000
Sub-base	351,000
Base Course	180,000
Pavement	540,000
	$4,583,000
Plus 5% Contingencies	229,000
	$4,812,000
Plus 10% Engineering	481,000
	$5,293,000

SECTION E – MILE 68 TO MILE 95

Clearing and Grubbing	$ 75,000
Common Excavation	905,000
Rock Excavation	4,838,000
Culverts	108,000
Bridges	120,000
Sub-base	527,000
Base Course	270,000
Pavement	810,000
	$7,653,000
Plus 5% Contingencies	383,000
	$8,036,000
Plus 10% Engineering	804,000
	$8,840,000

SECTION F – MILE 68 TO MILE 84

Clearing and Grubbing	$ 55,000
Common Excavation	515,000
Rock Excavation	2,012,000
Culverts	64,000
Bridges	120,000
Sub-base	320,000
Base Course	160,000
Pavement	480,000
	$3,726,000
Plus 5% Contingencies	186,000
	$3,912,000
Plus 10% Engineering	391,000
	$4,303,000

TOTAL ESTIMATED COST

WARM PASS ROUTE

SECTION	A	$4,848,000	
	C	5,085,000	
	D	5,293,000	
	E	8,840,000	
			$24,066,000

TUTSHI VALLEY ROUTE

SECTION	A	$4,848,000	
	C	5,085,000	
	D	5,293,000	
	F	4,303,000	
			$19,529,000

WHITEHORSE – SKAGWAY

3.5 REFERENCES – MAPS AND AERIAL PHOTOGRAPHS

The routes and estimates have been produced from the following data:

(1) National Topographic Map Sheets 1:50,000 with a 100 foot contour interval:

MacRae
Carcross West Half
Carcross East Half
White Pass
Warm Creek

(2) Enlargement 1" = 1000' made from the above topographic maps on which preliminary lines were plotted and profiles produced to assist in computing quantities.

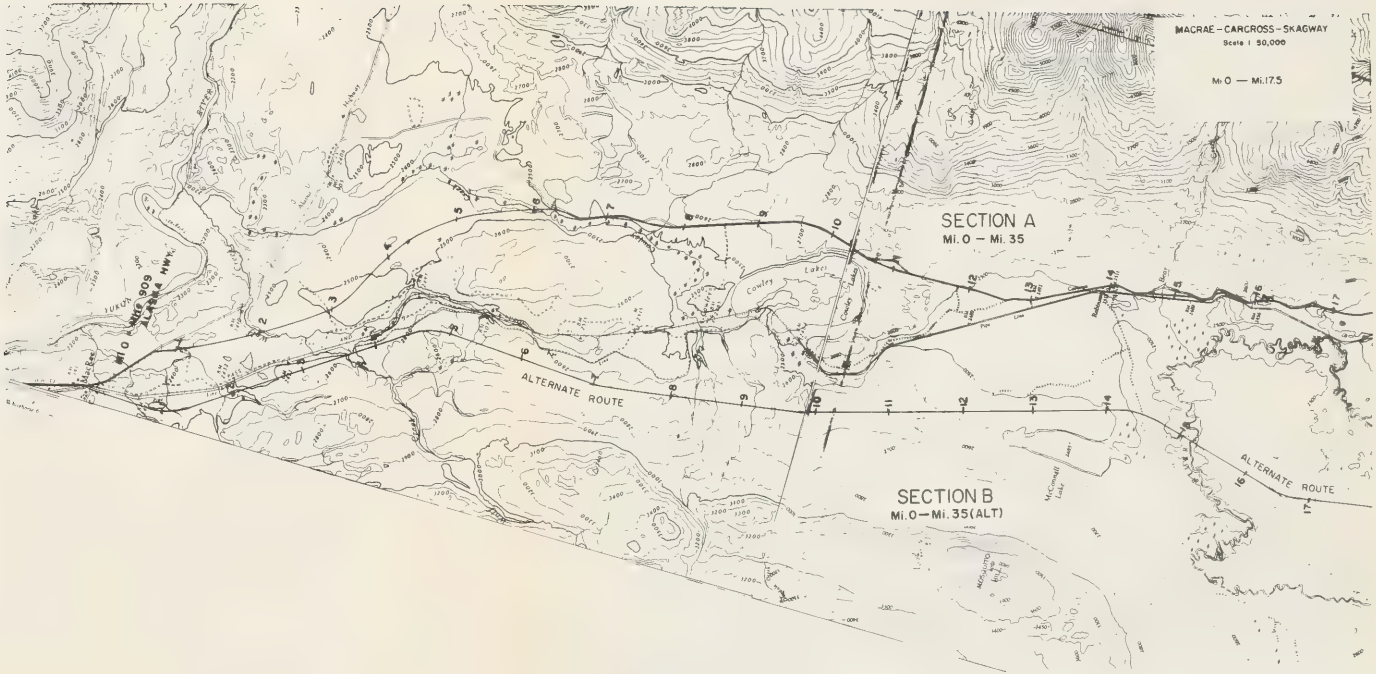
(3) Aerial photography to scales of 1" = 2460' and 1" = 5000' obtained from the Department of Mines and Technical Surveys Branch.

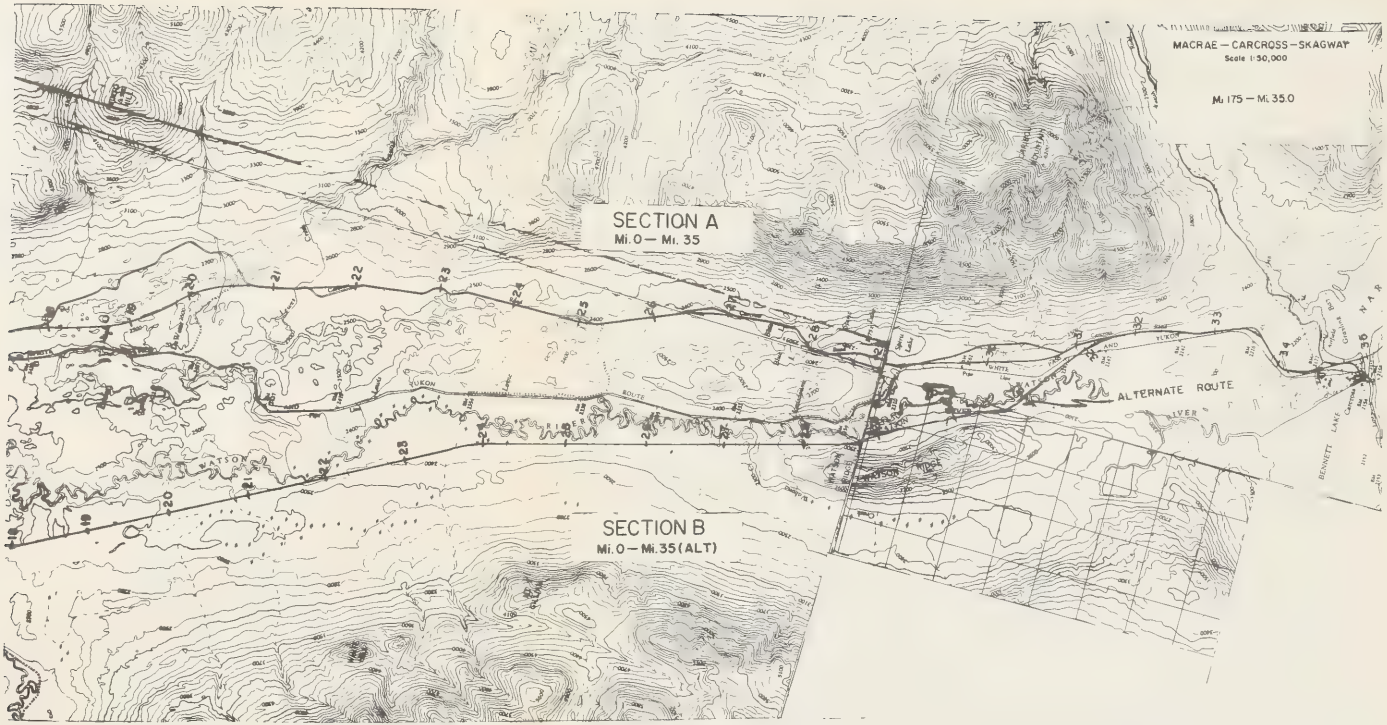
(4) (i) Mile 909 of the Alaska Highway is designated as Mile 0 of the Skagway Highway.

(ii) Mile 95 of the Warm Pass Route (International Boundary) may be designated as latitude 59°-32'-50", longitude 135°-01'-40", at an elevation of approximately 3100' above sea level.

(iii) Mile 84 of the Tutshi Valley Route (International Boundary) may be designated as latitude 59°-37'-51", longitude 135°-09'-48", at an elevation of approximately 3100' above sea level.


MacRae
Mi. 0
ALASKA
HIGHWAY
Carcross
Mi. 35
Mi. 68
Mi. 83·6
Mi. 89
Mi. 102
Mi. 94·5
Mi. 109
Mi. 96
Skagway
MACRAE - CARCROSS - SKAGWAY
KEY MAP
Scale
0
8
16


MACRAE - CARCROSS - SKAGWAY
Scale 1 50,000
Mi 0 — Mi.17.5
SECTION A
Mi. 0 — Mi. 35
SECTION B
Mi. 0 — Mi. 35 (ALT)
ALTERNATE ROUTE
ALTERNATE ROUTE
YUKON 909 ALASKA HWY.
Mi 0 ALASKA HWY.
Cowley Lake
Canoe Lakes
McConnell Lake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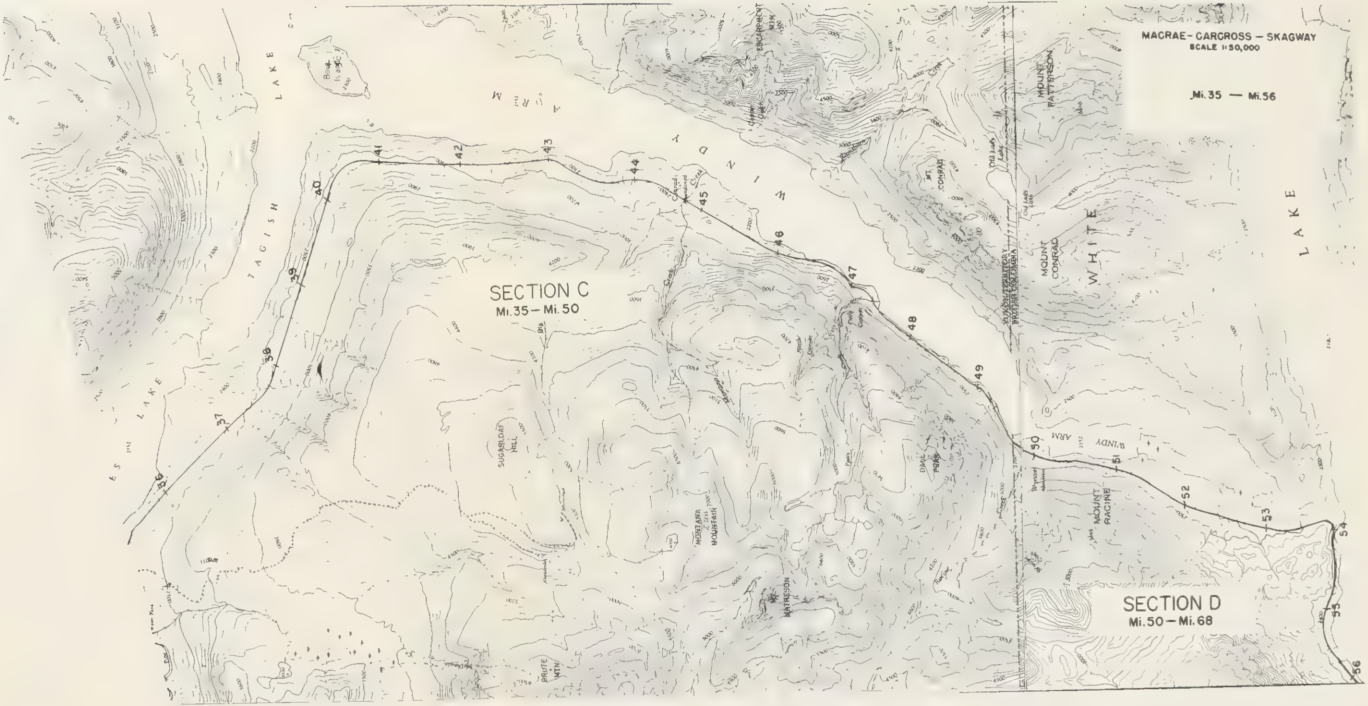
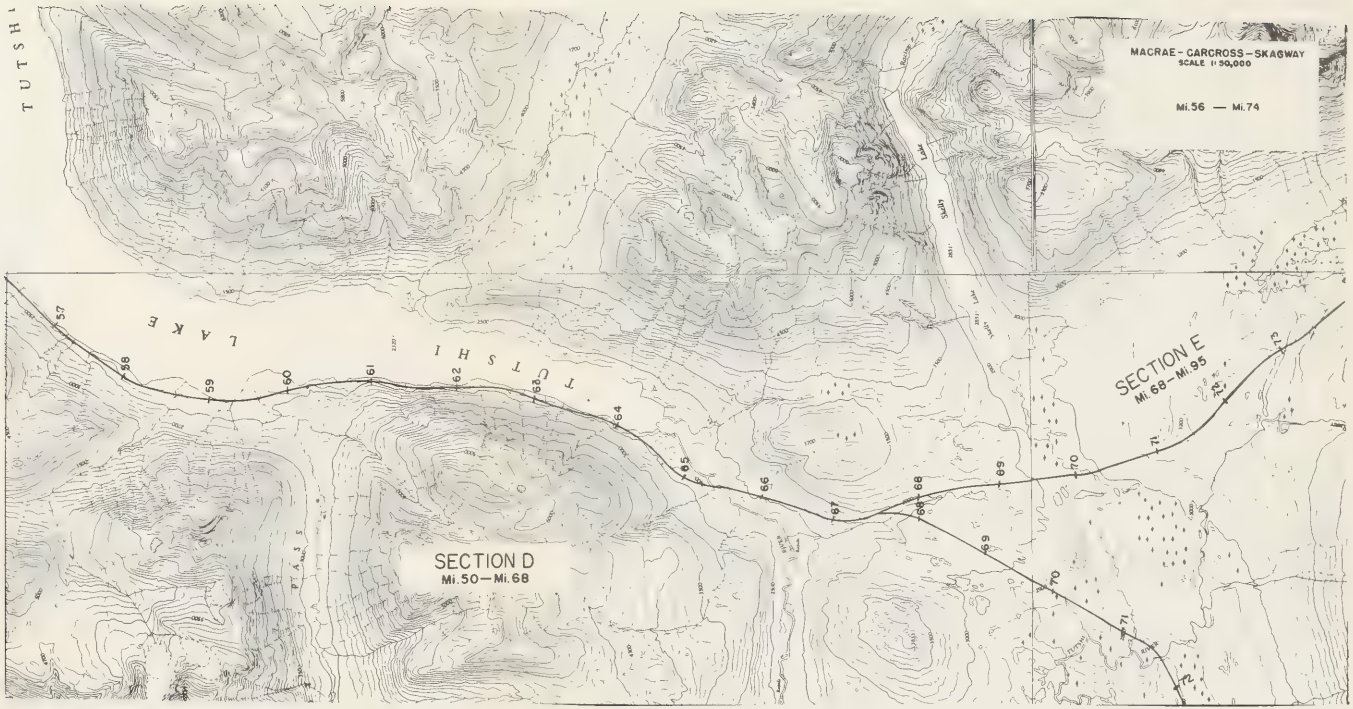
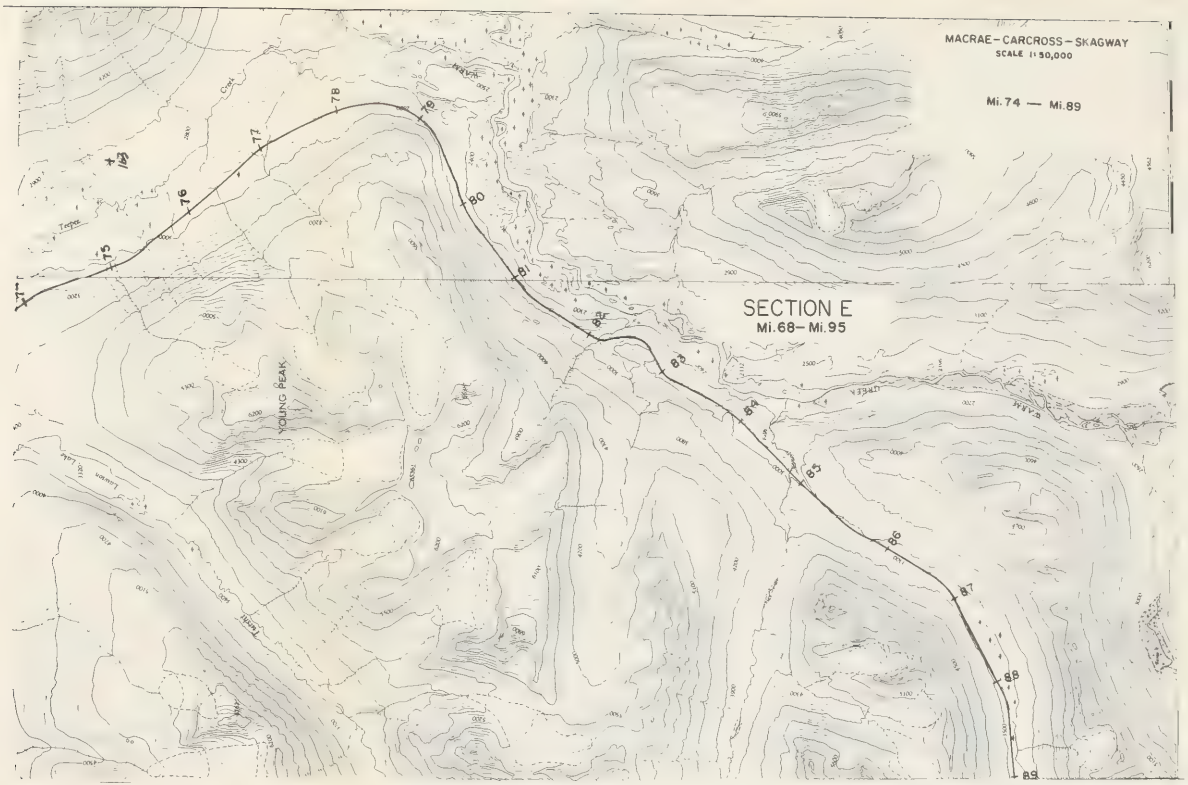
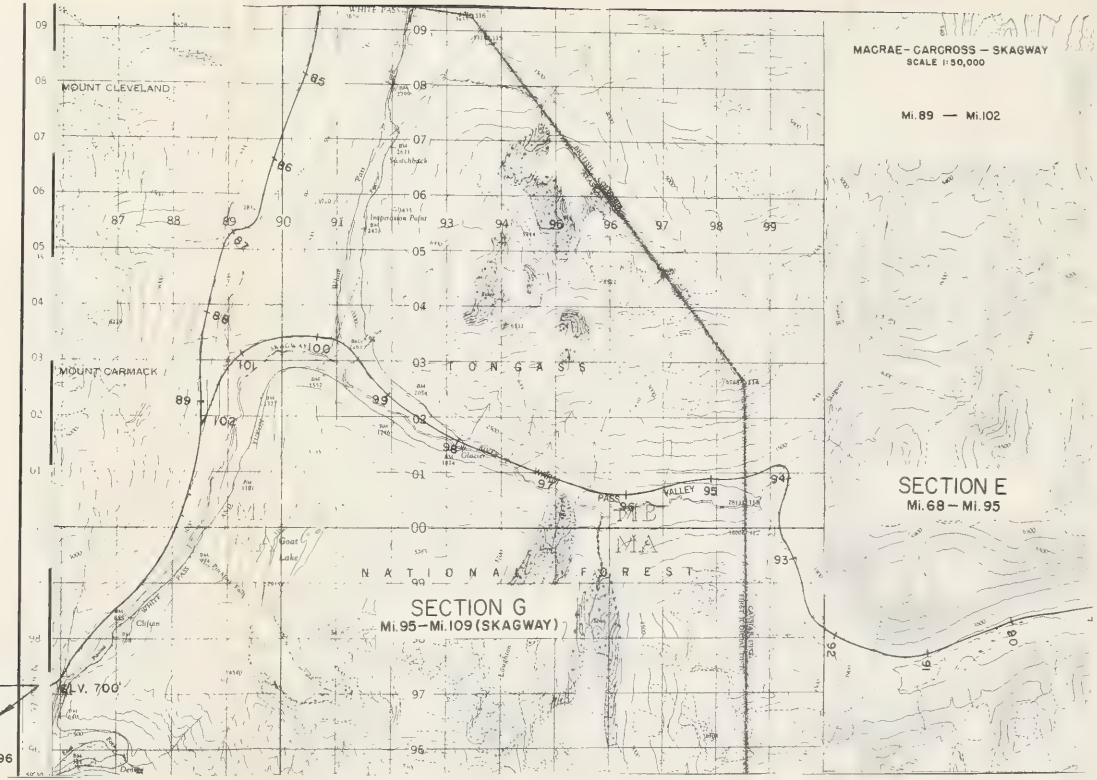
Scale 1:50,000
Mi 175 — Mi. 350
SECTION A
Mi. 0 — Mi. 35
SECTION B
Mi. 0 — Mi. 35 (ALT)
ALTERNATE ROUTE
YUKON
RIVER
ROUTE
BENNETT LAKE

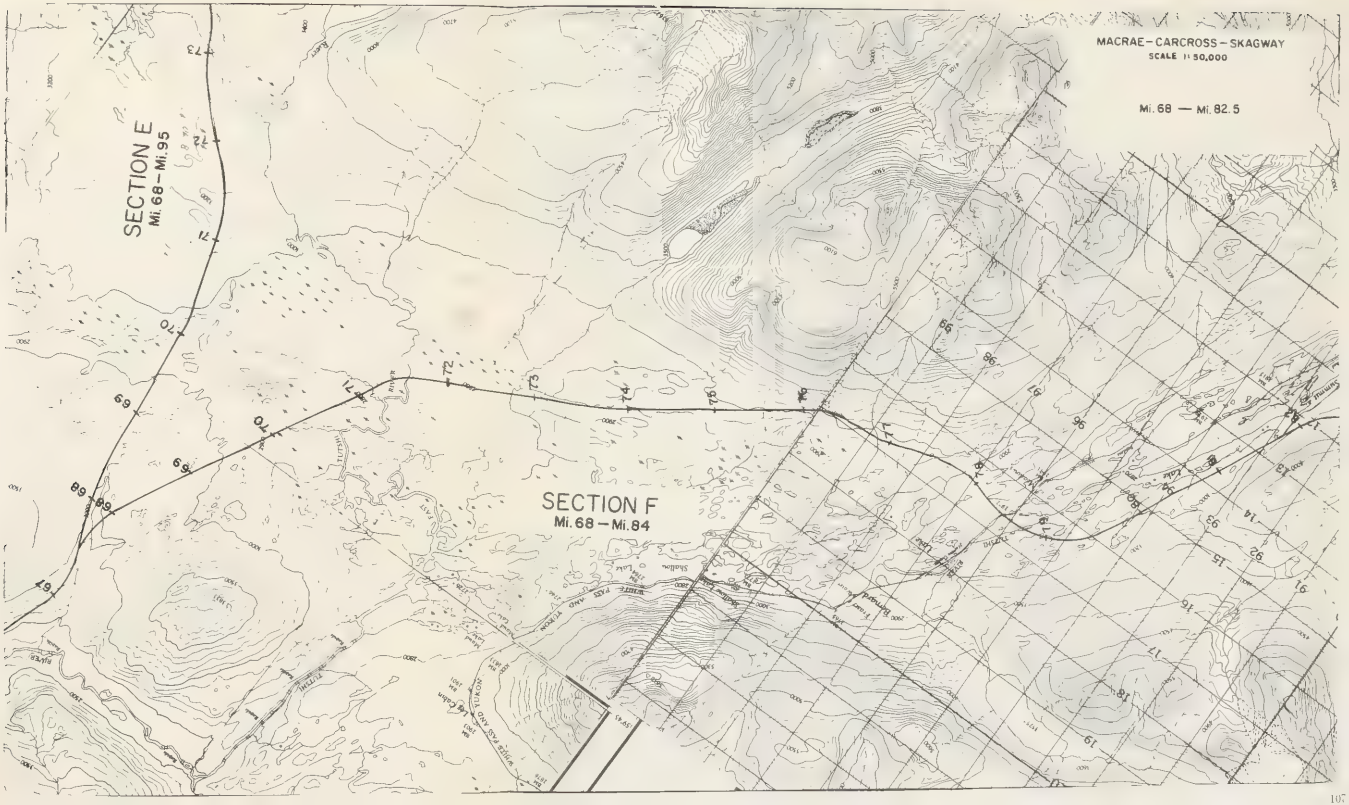


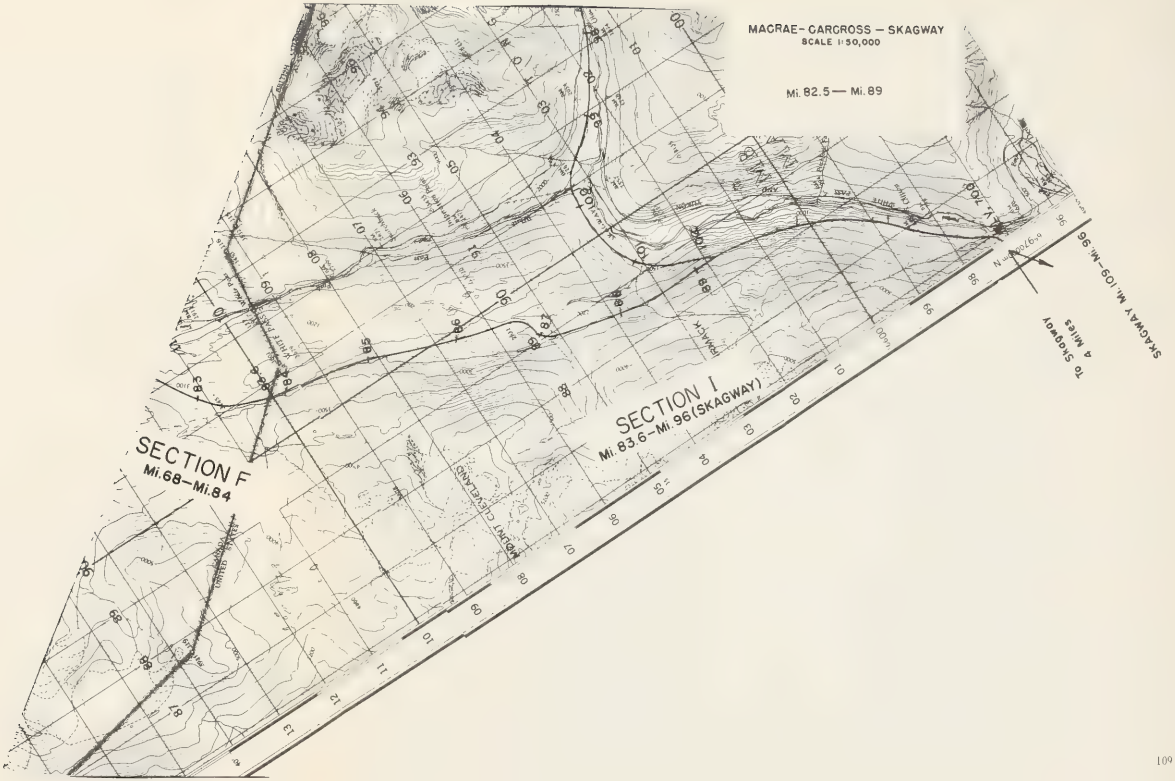
MACRAE - CARCROSS - SKAGWAY
SCALE 1:50,000
Mi. 35 — Mi. 56
SECTION C
Mi. 35 — Mi. 50
SECTION D
Mi. 50 — Mi. 68
TAGISH LAKE
WINDY ARM
WHITE LAKE
MOUNT PATTERSON
MOUNT CONRAD
MT. CONRAD
SUGARLOAF HILL
MONTANA MOUNTAIN
MOUNT RACINE
DAIL PEAK
BRUTE MTN
ESCARPMENT MTN
YUKON TERRITORY
BRITISH COLUMBIA


MACRAE - CARCROSS - SKAGWAY
SCALE 1: 50,000
Mi. 56 — Mi. 74
SECTION D
Mi. 50 — Mi. 68
SECTION E
Mi. 68 — Mi. 95
TUTSHI LAKE
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74


MACRAE – CARCROSS – SKAGWAY
SCALE 1:50,000
Mi. 74 — Mi. 89
SECTION E
Mi. 68 – Mi. 95
YOUNG PEAK
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89


MACRAE – GARCROSS – SKAGWAY
SCALE 1:50,000
Mi. 89 — Mi. 102
MOUNT CLEVELAND
MOUNT CARMACK
TONGASS
NATIONAL FOREST
SECTION G
Mi. 95 – Mi. 109 (SKAGWAY)
SECTION E
Mi. 68 – Mi. 95
To Skagway
4 Miles
ELEV. 700'
SKAGWAY Mi. 109 – Mi. 96
WHITE PASS
Goat Lake
Clifton
Dyea
VALLEY
PASS


MACRAE – CARCROSS – SKAGWAY
SCALE 1: 50,000
Mi. 68 — Mi. 82.5
SECTION E
Mi. 68 – Mi. 95
SECTION F
Mi. 68 – Mi. 84


MACRAE - CARCROSS — SKAGWAY
SCALE 1:50,000
Mi. 82.5 — Mi. 89
SECTION F
Mi. 68 — Mi. 84
SECTION I
Mi. 83.6 — Mi. 96 (SKAGWAY)
SKAGWAY Mi. 109 — Mi. 96
To Scoggy
4 Miles

PHOTOGRAPHIC SUPPLEMENT
TO
APPENDIX C

RAINBOW LAKE ON CARCROSS ROAD MILE 25

CARCROSS BRIDGE MILE 35, LOOKING EAST TOWARDS NARES LAKE

NORTH DOWN WINDY ARM OF TAGISH LAKE
FROM APPROXIMATELY MILE 50

SOUTH UP TUTSHI LAKE FROM MILE 59

SOUTH UP WARM CREEK FROM MILE 83

SOUTHWEST TOWARDS SUMMIT WARM PASS FROM MILE 88

FROZEN LAKE SUMMIT WARM PASS APPROXIMATELY MILE 92

EAST TO SUMMIT WARM PASS FROM MILE 93

EAST TO SUMMIT WARM PASS FROM MILE 93

EAST TO SUMMIT WARM PASS FROM MILE 93

NEAR SUMMIT WARM PASS APPROXIMATELY MILE 93

NEAR SUMMIT WARM PASS APPROXIMATELY MILE 93

ESKER TUTSHI ROUTE LOOKING SOUTHWEST
FROM APPROXIMATELY MILE 71

NORTHEAST ACROSS TUTSHI VALLEY FROM MILE 78

NORTH ALONG SUMMIT LAKE FROM MILE 84 TUTSHI ROUTE

TO SUMMIT OF TUTSHI ROUTE IN ALASKA
APPROXIMATELY MILE 88

SOUTH TOWARDS SKAGWAY ALONG WHITE PASS RAILROAD

RAILROAD SNOWSHED NEAR WHITE PASS

SOUTH ALONG RAILROAD FROM SUMMIT OF WHITE PASS
NOTE DIFFICULTY OF CONSTRUCTION

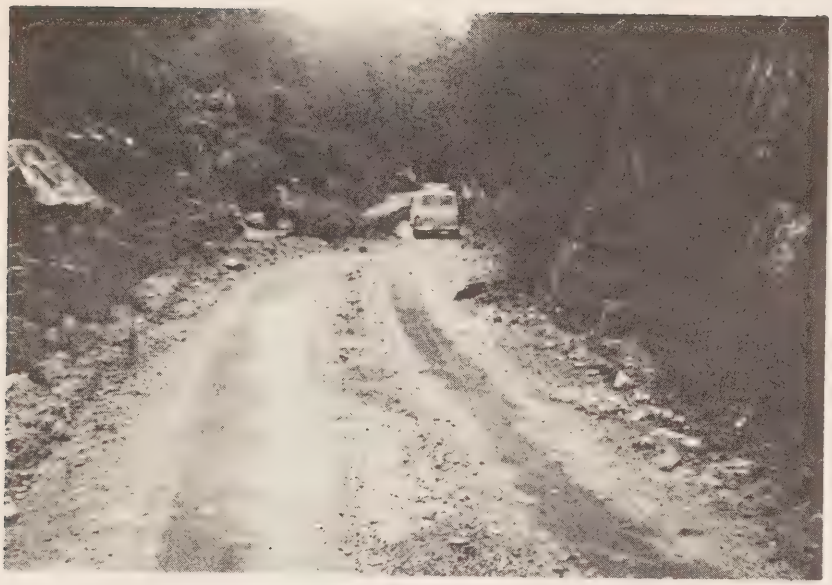
TRESTLE BRIDGE IN WHITE PASS

NORTH FROM MILE 22 ON WHITE PASS AND YUKON RAILROAD

NORTH DOWN BENNETT LAKE

NORTH DOWN BENNETT LAKE

SOUTH UP BENNETT LAKE



NARROW SECTION ROAD NORTH FROM SKAGWAY

END OF ROAD NORTH OF SKAGWAY

END OF ROAD NORTH OF SKAGWAY

APPENDIX D
MONTAGUE – KLUKSHU ROAD COST STUDY
PREPARED BY THE
DEPARTMENT OF PUBLIC WORKS, OTTAWA

HAUL ROUTE – CARMACKS-HAINES, ALASKA

As suggested by the Department of Indian Affairs and Northern Development possible routes for a haul road from Carmacks to Haines, Alaska, for the Anvil Mining Corporation have been assessed. The suggested route by way of Rowlinson Creek-Nisling River-Aishihik Road was examined last season as part of the Carmacks-Snag reconnaissance; and a route from Montague (on the existing Whitehorse-Carmacks road) by way of the Nordenskiold River Valley to Champagne at M.974 on the Alaska Highway, and on to M.117 on the Haines Road (Klukshu River Bridge) by way of the Dezadeash River and Dezadeash Lake, was subjected to a preliminary examination by helicopter this season.

The comparative locations of the two routes, with mileages, are shown on the attached 8 mile to 1 inch map. Brief description of the routes are as follows:

(A) ROWLINSON CREEK-NISLING RIVER-AISHIHIK ROAD ROUTE

This proposed route which is shown on the attached 8 mile to 1 inch map as a broken line, would follow the valley of Rowlinson Creek to a chain of small lakes, which would be followed in a southwesterly direction to the valley of the Nisling River, along which it would travel for approximately 12 miles. From this point an existing winter trail would be followed through a low pass into the Aishihik Lake watershed, and the existing Aishihik Road utilized from the vicinity of the radio range beacon to M.997 on the Alaska Highway.

The construction difficulties and the scarcity of materials encountered in the Rowlinson Creek area during the attempt to build an all-weather, low grade, single lane access road to the Mt. Nansen Mines Ltd. property in 1965 were discussed in detail on another occasion. To sum up, construction

was started on June 12, 1965 and abandoned on July 24, after completing 16.5 miles of access road. Of this distance, eight miles were completed by June 18, seven miles of this being in pitted outwash terrain following the route of an existing wood road. The remainder of the constructed route was across frozen glacial till. It was necessary to place corduroy ahead of the grade, and very little borrow was located, most of it coming from a pit at Mile 6. As a result, each mile was becoming progressively more costly to build, and though the average cost of the completed portion beyond Mile 7 was about $5,500.00 per mile, the contractor estimated that the cost of the last mile completed was $14,000.00.

Approximately a further nine miles of the same type of material remained ahead of the grade when work was stopped, for the reason that the project was proving more costly than the mining company had anticipated, in spite of the fact that they were receiving tote trail assistance. In view of the difficulties encountered in building a low standard road in this area, high construction costs and slow progress would justifiably be anticipated if this route were followed by a road built to development road standards.

Better materials are encountered when the chain of lakes is reached, but once into the Nisling River Valley construction problems would again be encountered. The broad, level floor of this section of the valley is generally covered with saturated, swampy material characterised by many small lakes and potholes and a cover of buck brush. A bench extends along the right side of the river from Victoria Creek southwesterly and the crest of this bench would have to be followed as closely as possible in order to remain in dry material. The bench unfortunately, is not continuous, being interrupted by the tributary streams coming into the Nisling from the north, principally Nansen Creek and Lonely Creek. The latter valley in particular would probably be difficult to cross.

At approximately M.40 the Nisling River valley is crossed and an existing winter road followed for 15 miles across the height of land into the Aishihik Lake watershed. Material in this portion appears to be fairly dry, with only a few poorly drained areas being encountered, and the grade out of the valley does not appear to offer any difficulties. An existing road links the radio range beacon in the summit area with the Aishihik Road. This road is narrow, with substandard alignment, though the route is generally dry with a good supply of granular material. However, as much of the terrain it follows, particularly along Aishihik Lake, is rough, with many steep side hills, it would

be costly to effect the necessary improvements in standards that would be required.

The total length of this route would be about 121 miles with 55 miles of this being completely new construction, much of it in difficult terrain, and the remainder, as stated, requiring costly upgrading.

(B) CHAMPAGNE-KLUKSHU ROUTE

This route, which would involve approximately 42 miles of new construction, is shown as a solid line on the attached 8 miles to 1 inch map. Mile 0 is assumed to be at the small settlement of Champagne located at M.974 on the Alaska Highway. For the first 20 miles this proposed route would follow the right or east bank of the Dezadeash River, and then run parallel to the east shore of Dezadeash Lake but at a distance of some two to three miles from it, and finally east of Klukshu Lake and the Klukshu River to a junction with the Haines Road just east of the Klukshu River bridge at M.117. The route generally follows a portion of the so-called Dalton Trail, constructed in 1898 as an access route from Pyramid Harbour on Chilkat Inlet to the Yukon River in the vicinity of Five Finger Rapids. This section of the trail was used largely by pack horses and oxen, and for cattle drives.

For two miles south of Champagne the proposed route would follow level, poplar covered flats, and then enters a narrower section of the valley and more broken terrain. From about M.3 to M.5 the best alignment appears to be close to the toe of the slope in order to avoid a series of knolls and gullies. From approximately M.8 to Mile 12 the valley floor is occupied by a number of small lakes and appears to be marshy. The route here should probably climb on to a bench along the side of the valley, staying sufficiently far back from the edge to avoid the small creek gullies. From this point to Mile 20 the valley gradually widens and the terrain the road would follow consists of poplar covered knolls and ridges interspersed with stream gullies and dry poplar and spruce covered flats.

From M.20 to about M.27 the road would traverse a low pass, skirting three small lakes and following benches or dry side hills, and reaching its maximum elevation of approximately 2800 feet. Between M.27 and M.28 a swampy creek is crossed. From here to M.37 there are a number of poplar ridges, and generally the best route appears to follow these. Three miles of fairly

rough but apparently dry country is followed to the discharge of Klukshu Lake. At M.40, and the remaining mile would be along a steep side hill with heavy spruce cover on the left bank of the Klukshu River. This side hill may be wet, but could be avoided if necessary by an alternate route along the approximate location indicated on the attached map.

Generally, this route would follow dry ground, with predominately poplar or poplar and spruce tree cover. Grades would present no problem, and the only difficulties in alignment would be in those sections where the terrain is rough and broken. Some of the benches and ridges should contain granular material, though it was not possible to confirm this at the time. On the whole, it should be possible to construct this road quickly and at a reasonable cost.

(C) CHAMPAGNE-MONTAGUE ROUTE

This route, which also follows the Dalton Trail, would involve 77 miles of new construction, and is shown as a solid line on the attached 8 miles to 1 inch map. Mile 0 is assumed to be at Champagne. About five miles north of Champagne this route would enter a pass through a range of low hills, reaching at this point its maximum elevation of 3000 ft. The climb into this pass is a gradual one, and the ground appears generally dry and well drained. Leaving the pass, there is some rough country in the vicinity of Mile 10, where it is necessary to cross an unnamed tributary of the Mendenhall River. The best route in this area would appear to be along a bench fairly high above the river on the east side, then dropping down to the tributary close to its junction with the Mendenhall. The right or west side of this river is then followed to M.15. Two miles beyond this point is the south end of Hutshi Lakes, a chain of narrow lakes which extend to M.30, and which are the headwaters of the Nordenskiold River.

There are high, relatively uniform benches along both sides of the lakes. The bench on the east side was examined during this reconnaissance. The soil appears dry, much of the bench having been burned over; with the remaining timber being mixed spruce and poplar. There would be two stream gullies to cross, but neither appears very difficult. There are surface boulders in some sections. At the outlet of the lakes, at M.30, it is necessary to cross to the west side of the valley to avoid a bad side hill on the east side, about ten miles north of the lakes, where

several mud slides have occurred. To avoid this crossing, the possibilities of a road route on the west side of Hutshi Lakes should also be investigated.

The left, or west, bank of the Nordenskiold appears preferable from a construction point of view. Between M.30 and M.40 the valley is fairly narrow with steep side walls, and as the valley floor appears marshy and the river close to the west side of the valley, some side hill construction would be necessary. Beyond this point the valley becomes wider, and the greater part of the remainder of the route would be on poplar or spruce covered flats, or benches. In the vicinity of M.50 a number of small potholes occupy the valley floor, and side hill construction might again have to be resorted to. Several extensive sections of the valley have also been burned over. Generally, the soils appear dry, and granular material should be available.

As already stated, these last two routes, which together constitute one cutoff road, lend themselves to a two-stage construction program, with the Champagne-Klukshu portion being built first, thereby effecting an immediate saving in distance between Carmacks and Haines, Alaska, of 43 miles; and the Champagne-Montague portion built later, effecting a further saving in distance of 52 miles, for a total of 95 miles in all. In both these sections, construction would be possible from either or both ends of the proposed road.

SUMMARY OF HAUL DISTANCES

A summary of the haul distances involved is set out in the following tables, with the savings and amounts of new construction for each route indicated. The distances for the newly constructed portions may of course vary somewhat from those shown, but should be sufficiently accurate for a valid comparison.

Existing Road – Carmacks-Haines, Alaska

	Miles	Totals
Carmacks-Mayo Cutoff	103	
Mayo Cutoff-Haines Junction (1016)	91	
Haines Junction – Haines, Alaska	159	353

Champagne-Klukshu River Bridge (via Dezadeash River) Phase 1 of Construction Program

Carmacks-Mayo Cutoff	103	
Mayo Cutoff – Champagne	49	
Champagne-Klukshu River Bridge	41	
Klukshu River Bridge-Haines, Alaska	117	310

Savings in distance – 43 miles
New Construction – 41 miles

Montague-Champagne (via Nordenskiold River)
Phase II of Construction Program

	Miles	Totals
Carmacks-Montague	23	
Montague-Champagne	77	
Champagne-Klukshu River Bridge	41	
Klukshu River Bridge-Haines, Alaska	117	258

Savings in distance (Phase I & II) – 95 Miles
New Construction, Phase II 77 miles
Total New Construction 118 miles

Carmacks-Aishihik Route

Carmacks-Aishihik-Alaska Highway (M.997)	121	
M.997-Haines Junction	19	
Haines Junction-Haines, Alaska	159	299

Saving in distance – 54 miles
New Construction – 55 miles
Extensive upgrading – 66 miles

SUMMARY

In comparing the Carmacks-Aishihik route and the Montague-Champagne-Klukshu route, the salient points may be summarized as follows:

CARMACKS – AISHIHIK – ALASKA HIGHWAY ROUTE

- probable high costs of new construction due to unfavorable terrain (55 miles),
- expensive upgrading of existing road (66 miles),
- savings in haul distance (54 miles) not proportionate to probable high construction costs, when compared with other route.

MONTAGUE-CHAMPAGNE-KLUKSHU ROUTE

- generally good road building terrain, therefore cheaper construction costs,
- more new construction involved (118 miles), but cost per mile of new construction on this route would be generally in line with, or lower than, cost of upgrading existing Aishihik Road,
- greater savings in haul distance (95 miles),

– lends itself to a two-phase construction program, with the 41 miles Champagne-Klukshu portion to be constructed first, resulting in an immediate saving in haul distance of 43 miles.

RECOMMENDATION

If Anvil Corporation make a firm decision to ship ore by way of the port of Haines, Alaska, then construction of the Montague-Champagne-Klukshu cutoff is definitely recommended, with the Champagne-Klukshu portion being built first. This entire route will effect a worthwhile saving in haul distance at a reasonable cost.

COST ESTIMATE – CARMACKS-HAINES CUTOFF

The estimated cost of the various routes considered in this report is as follows. These estimates are based on 1966 construction costs.

The mileages in the following table are those used on the attached map, with Mile 0 for the Aishihik Route being at Carmacks, and Mile 0 for both phases of the Montague-Klukshu cutoff being at Champagne.

Carmacks-Aishihik Route (via Rowlinson Creek)

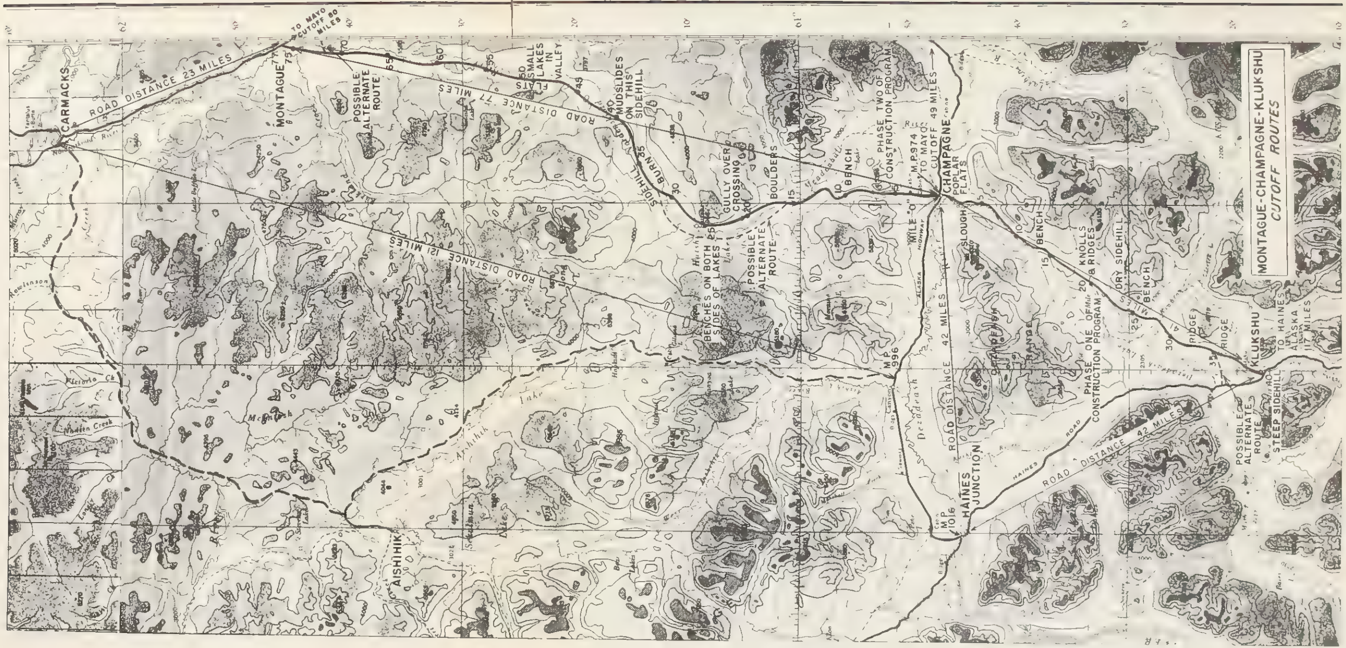
Mile	Cost/Mile	Totals
0 - 20	60,000	1,200,000
20 - 30	40,000	400,000
30 - 55	50,000	1,250,000
55 - 121	40,000	2,640,000
		5,490,000

Montague-Klukshu Route
Champagne-Klukshu – Phase I

0 - 5	35,000	175,000
5 - 20	45,000	675,000
20 - 30	40,000	400,000
30 - 41	50,000	550,000
		1,800,000

Champagne-Montague – Phase II

0 - 10	35,000	350,000
10 - 60	40,000	2,000,000
60 - 77	35,000	595,000
		2,945,000
Total – Phase I & II		4,745,000


MONTAGUE-CHAMPAGNE-KLUKSHU
CUTOFF ROUTES
CARMACKS
ROAD DISTANCE 23 MILES
TO MAYO CUTOFF 80 MILES
MONTAGUE
POSSIBLE ALTERNATE ROUTE
ROAD DISTANCE 77 MILES
SMALL LAKES IN VALLEY
FLATS
MUDSLIDES ON THIS SIDEHILL
BURN
SIDEHILL
GULLY OVER CROSSING
BOULDERS
BENCH
PHASE TWO OF CONSTRUCTION PROGRAM
M.P. 974 TO MAYO CUTOFF 49 MILES
CHAMPAGNE
POPLAR FLATS
MILE "0"
SLOUGH
BENCH
KNOLLS & RIDGES
DRY SIDEHILL
BENCH
RIDGE
RIDGE
KLUKSHU
TO HAINES ALASKA 117 MILES
ROAD DISTANCE 121 MILES
BENCHES ON BOTH SIDES OF LAKES
POSSIBLE ALTERNATE ROUTE
M.P. 996
ROAD DISTANCE 42 MILES
PHASE ONE OF CONSTRUCTION PROGRAM
HAINES JUNCTION
M.P. 1016
HAINES ROAD
ROAD DISTANCE 42 MILES
POSSIBLE ALTERNATE ROUTE
STEEP SIDEHILL
AISHIHIK
ALASKA HIGHWAY
Victoria Ck
Nordenskiold River


ELEVATIONS IN FEET
ELEVATIONS IN FEET
ELEVATIONS IN FEET
ELEVATIONS IN FEET
Lambert Conformal Conic Projection
Standard Parallels 62°30' and 63°30'
HYPSOMETRIC TINTS
CONVERSION TABLE
LOGARITHMIC SCALE
Dawson
Keno Hill
Mayo
Snag
Carmacks
Ross River
Tungsten
Aishihik
Klaune
Canyon
Champagne
Haines Junction
WHITEHORSE
Klukshu
Carcross
Watson Lake
Atlin
Skagway
Haines
Cassiar
HESS MOUNTAINS
DAWSON RANGE
ANVIL RANGE
CASSIAR MOUNTAINS
YUKON TERRITORY
ALASKA
BRITISH COLUMBIA
NORTHWEST TERRITORIES
RELIEF DATA INCOMPLETE
GULF OF ALASKA
UNITED STATES OF AMERICA
CANADA
141°
140°
139°
138°
137°
136°
135°
134°
133°
132°
131°
130°
129°
128°
64°
63°
62°
61°
60°
59°


YUKON – BRITISH COLUMBIA – ALASKA
REGION
Scale
0 16 32 48 miles
LEGEND
Boundary : International
Boundary : Provincial
Railroad (Single Track)
Roads
Trail
2000 Contours
7085 Spot Elevation
RELIEF DATA INCOMPLETE
YUKON TERRITORY
ALASKA
BRITISH COLUMBIA
YUKON TERRITORY
BRITISH COLUMBIA
ALASKA
Aishihik
Kloune
Canyon
Haines Junction
Champagne
WHITEHORSE
Klukshu
Carcross
Skagway
Haines
Atlin
Watson Lake
Cassiar
Dease Lake
Telegraph Creek
JUNEAU
PRINCE OF WALES ISLAND
KUPREANOF ISLAND
MOUNTAINS
CASSIAR
MOUNTAINS
COAST
MOUNTAINS
GULF OF ALASKA
ELEVATIONS IN FEET
ELEVATIONS IN FEET
Stewart